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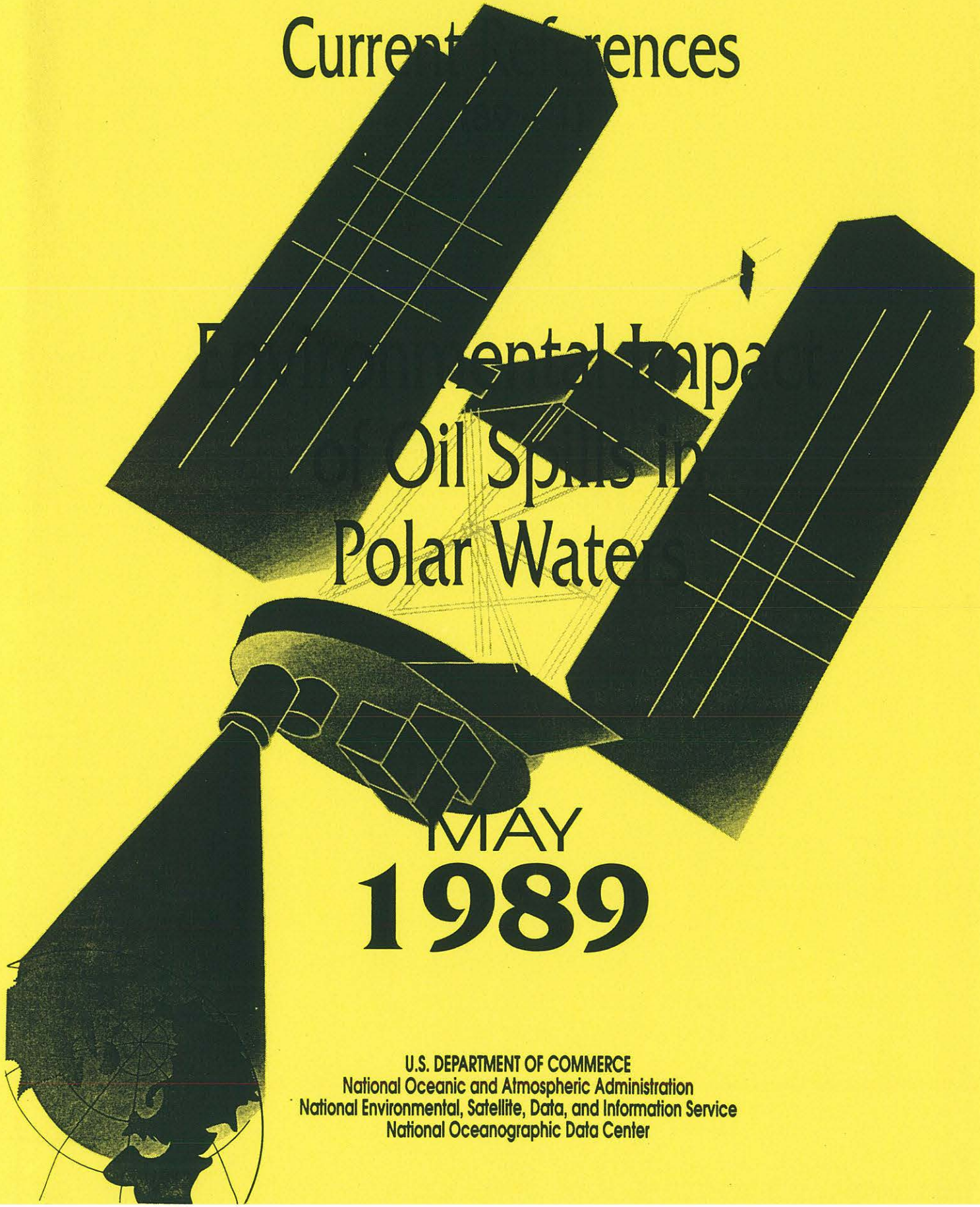

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Environmental, Satellite, Data, and Information Service
National Oceanographic Data Center

Environmental Impact of Oil Spills in Polar Waters

May 1989

The recent oil spill in Alaska (Exxon Valdez, March 24, 1989) brought renewed attention to the need to know more about the effects of petroleum pollution on marine ecosystems. Many studies have been done in the past, especially under the aegis of the National Oceanic and Atmospheric Administration.

The object of this bibliography is to present an overview of materials available on the subject. It is not intended to be a comprehensive literature review, but rather to be a selective compilation of citations retrieved from relevant databases.

Database (DIALOG)	Yrs. covered
1. Aquatic Sciences & Fisheries Abstracts (ASFA) File 44	1978-present
2. National Technical Information Service (NTIS) File 6	1980-present
3. Biological Abstracts (BIOSIS Previews) File 5	1980-present
4. Pollution Abstracts File 41	1975-present
5. DOE Energy File (EDB) File 103	1983-present

1. **Sources, Fates and Effects of Aromatic Hydrocarbons in the Alaskan Marine Environment with Recommendations for Monitoring Strategies.**
Anderson, J. W. ; Neff, J. M. ; Boehm, P. D. Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab., March 1986.

Abstract: Information about polycyclic aromatic hydrocarbons in the Alaskan marine environment is relatively sparse. About 300 references were reviewed to create an assessment of the current state of knowledge on sources, fates and effects of oil-derived polycyclic aromatic hydrocarbons in cold marine waters. The objective of the report is to critically review what is known about the sources, fates and effects of polycyclic aromatic hydrocarbons (PAH) in the Alaskan marine environment. The specific areas reviewed are (1) the natural and anthropogenic sources of aromatic hydrocarbons in the Alaskan marine environment, (2) the physical, chemical and biochemical fates of these compounds in marine ecosystems, and (3) the bioaccumulation and biological effects of aromatic hydrocarbons in marine organisms.
Sponsored by Corvallis Environmental Research Lab., OR.
RN: EPA/600/3-86/018.
NTIS Order No.: PB86-168291/XAB. DIALOG NTIS FILE 6

2. **Prudhoe crude oil in arctic marine ice, water, and sediment ecosystems: degradation and interactions with microbial and benthic communities. Presented at: Symposium on Recovery Potential of Oiled Marine Norther Environments Halifax (Canada) 10 Oct 1977.**
Atlas, R. M.; Horowitz, A.; Busdosh, M. Dep. Biol., Univ. Louisville, KY 40208, USA. Canada. Fish. Res. Board. Journal, Vol.35, No. 5, pp. 585-590, 1978.

Abstract: A variety of in situ models were used to simulate oil spills in different arctic ecosystems. Numbers of oil-degrading microorganisms were found to increase after oil contamination. Oil contamination of sediment resulted in mortality of indigenous invertebrates. Recolonization of oil-contaminated sediments began shortly after oil contamination but benthic communities were significantly different in oil-contaminated sediment compared with the control, 2 months after oil contamination. Petroleum hydrocarbons were degraded slowly. Ice greatly restricted losses of light hydrocarbons. Following initial abiotic losses, biodegradation of oil was limited and did not significantly alter the relative percentages of hydrocarbons in the residual oil. The authors concluded that petroleum hydrocarbons will remain in arctic ecosystems for prolonged periods after oil contamination. DIALOG ASFA file 44

3. **Effects of a tanker accident and an oil blowout in Bristol Bay Alaska USA on returning adult sockeye slamon Oncorhynchus-Nerka. A simulation study.**
Bax, N. J. Natl. Marine Fish. Serv., Northwest Alaska Fish. Cent.; Resource Ecology Fish. Management, 7600 Sand Point Way NE, Bldg. 4, Seattle, WA 98115, USA. MAR. ENVIRON. RES., Vol. 22, No. 3, pp. 177-204, 1987.

Abstract: The effects of a tanker accident releasing 34000 tons of diesel fuel and a blowout releasing 3000 t/day of crude oil on adult sockeye salmon returning through Bristol Bay, Alaska, were simulated. Parameters in the simulation were chosen to maximize possible effects of the oil. Mortalities from the tanker accident were predicted to range from 2% to 18% of the adults passing through the spill area or 1% to 5% of the total returning population. From 3% to 7% of the adults surviving migration through the spill area, or 1% to 2% of the total population, could be tainted at or above 0.6 ppm of hydrocarbons in the flesh. As many as 30% of the adults returning of fishing grounds closest to the spill area could be tainted. Effects of the blowout on returning salmon were less severe than those of the tanker accident, with mortalities reaching a maximum of 0.2% of the adults passing through the area of the blowout, and no tainting predicted above 0.6 ppm. DIALOG BIOSIS Previews File 5

4. **Natural oil seeps in the Alaskan marine environment. Final report.** Becker, P. R.; Manen, C. A. National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div., May 1988.

Abstract: This report is a synthesis of information on the marine and coastal oil seeps in Alaska, and on the effects of chronic oil pollution on Arctic marine biotic communities and ecological processes. Of 29 oil seepage areas reported along the Alaskan coast, 14 have been confirmed as containing actual oil seeps. Large areas of coastal seepage have been identified in the central Gulf of Alaska and Arctic regions. When compared to known seepage rates on the California coast, the amount of oil entering the Alaska marine environment from known coastal seeps is probably rather small. Also, the organic enrichment of the benthic communities demonstrated at California seeps might not be as evident at Arctic seeps because of slower rate of oil degradation in the latter. Additional hypotheses on the effects of natural seeps on biological communities and ecosystems are discussed.
NTIS Order No.: PB-88-235965/XAB. DIALOG DOE Energy file 103

5. **Proceedings of the Workshop on Government Oil Spill Modeling Held at Wallops Island, Virginia on November 7-9, 1979.**
Bishop, J. M. National Oceanic and Atmospheric Administration, Washington, DC. Environmental Data and Information Service., February 1980.

Abstract: A workshop on Government Oil Spill Modeling Activities was convened by the Environmental Data and Information Service (EDIS) of the National Oceanic and Atmospheric Administration (NOAA), November 7-9, 1979. The meeting was held at the National Aeronautics and Space Administration (NASA) training facility at Wallops Island, VA. The workshop brought together oil spill model users and modelers for the purpose of fostering joint communication and increasing understanding of mutual problems. The workshop concentrated on defining user needs, presentations on ongoing modeling programs, and discussions of supporting research for these modeling efforts. Specific user recommendations include the development of an oil spill model user library which identifies and

describes available models. One user concern was the development of models for the long-term fate and effect of spilled oil.
NTIS Order No.: PB80-190945. DIALOG NTIS FILE 6

6. **The BIOS Project-an update. 1983 Oil Spill Conference.**
Blackall, P. J.; Sergy, G. A. Environment Canada Edmonton, Alberta. American Petroleum Institute conference on oil spill, February 1983.

Abstract: The Baffin Island Oil Spill (BIOS) Project, formally begun in March 1980, now is entering the fourth and final year of the planned field work. The primary objectives of this internationally funded project are to: determine if the use of chemical dispersants in the artic nearshore will reduce or increase the environmental effects of spilled oil, assess the fate of oil, and compare the relative effectiveness of other shoreline protection and cleanup techniques. This paper provides an overview of studies sponsored by the BIOS Project during the first three field seasons. Highlighted are the major oil releases which involved a total of 40 cubic meters of medium gravity crude oil. In addition, the preliminary results of the pre- and post-spill physical, chemical, and biological studies are presented. The physical program studies predicted the proper time and location for the oil releases and monitored the subsequent physical fate and behavior of the oil. The chemical program studies monitored the pre- and post-spill hydrocarbon levels in the water, sediments, and tissue of selected macrobenthic species, and also the environmental chemistry of the study area. The biological program studies to date have characterized the macrobenthic flora and fauna, the microorganisms, and the shorter-term effects of the oil releases on the subtidal biota. The potential ramifications of the BIOS Project's results on future oil spill countermeasure strategies are discussed.
RN: CONF-830275-. DIALOG DOE Energy file 103

7. **Long-Term Effects of Offshore Oil and Gas Development: An Assessment and a Research Strategy. Final report.**
Boesch, D. F. ; Rabalais, N. N. Louisiana Universities Marine Consortium, Chauvin., June 1985.

Abstract: The book includes technical assessments regarding the environmental implications of Outer Continental Shelf oil and gas development in thirteen topical areas ranging from 'Petroleum Industry Operations: Present and Future' to 'A Review of Study Designs for the Detection of Long-term Environmental Effects of Offshore Activities.' These technical assessments support an analysis which identifies the following future research needs: Chronic effects from the persistence of medium and high molecular weight aromatic hydrocarbons and heterocyclics and their degradation products in sediments and cold environments; Residual damage from oil spills to biogenically structured communities such as coastal wetlands, reefs and vegetation beds; Effects of channelization for pipeline routing and navigation on wetlands; Effects of fouling by oil of birds, mammals, and turtles, especially in species in which a large percentage of the population aggregates at certain times; Effects on benthos of drilling discharges accumulated through field development; Effects of produced water discharges generated offshore but discharged into nearshore environments; Effects of noise and other physical disturbances on populations of birds, mammals and turtles; Reduction of fishery stocks due to mortality of eggs and larvae as a result of oil spills; Effects of man-made, usually gravel, islands and causeways in the Arctic on benthos and anadromous fish species.
Sponsored by National Marine Pollution Program Office, Rockville, MD. NTIS Order No.: PB86-104114/XAB. DIALOG NTIS FILE 6

8. **Erosion, Deposition, Faulting, and Instability of Shelf Sediments: Eastern Gulf of Alaska. Section 3. The Taxonomy, Ecology, and Zoogeography of the Holocene and Pleistocene Ostracode Fauna of the Gulf of Alaska. Final report, March 1982.**
Brouwers, E. M. ; Molnia, B. F. National Ocean Service, Anchorage, AK. Ocean Assessments Div. Outer Continental Shelf Environmental Assessment Program. Final Reports of Principal Investigators. Volume 47, pp. 57-638, November 1986.

Abstract: The primary goal of the study has been to provide pertinent information on the age, environment, and sediment transport of continental shelf sediments of the northeast Gulf of Alaska based on the ostracode assemblages. In addition, these studies provide information tabulating the ostracode species present as well as associated faunal and floral elements. These data on the patterns of distribution and abundance of benthic organisms provide a baseline prior to the development of oil and gas leases on the continental shelf of the Gulf of Alaska.
Sponsored by Minerals Management Service, Anchorage, AK. Alaska Outer Continental Shelf Office. Included in Outer Continental Shelf Environmental Assessment Program. Final Reports of Principal Investigators, v47 p57-638 Nov 86.
NTIS Order No.: PB87-195012/XAB. DIALOG NTIS FILE 6

9. **Petroleum: properties and analyses in biotic and abiotic systems.**
Clark, R. C., Jr.; Brown, D. W. NOAA, National Marine Fisheries Service, Northwest and Alaska Fisheries Center, Seattle, WA 98112 USA. In: Effects of petroleum on Arctic and Subarctic marine environments and organisms. Volume 1: Nature and fate of petroleum, pp. 1-89, 1977.

Abstract: Information is provided on the nature of petroleum with specific analyses of its physical characteristics and the chemical properties of petroleum and petroleum products. Methods of analysis for the detection and identification of petroleum hydrocarbons are set forth and details are given on the hydrocarbons and non-hydrocarbons in petroleum and organisms. The level of non-hydrocarbon components in crude petroleum is generally only a few percent, although it can reach as high as 50%. These compounds are of particular interest, because many of them are toxic to marine organisms and are relatively soluble in water. The toxic non-hydrocarbon compounds in petroleum include cresols, xylenols, naphthols, carboxylic acids, quinoline and substituted quinolines, hydroxybenzoquinolines, and substituted pyridines. DIALOG ASFA file 44

10. **Effects of oil spills in arctic and subarctic environments.**
Clark, R. C.,Jr.; Finley, J. S. National Marine Fisheries Service, Northwest and Alaska Fisheries Center, Seattle, WA 98112, USA. In: Effects of petroleum on arctic and subarctic marine environments and organisms. Volume 2. Biological effects, pp. 411-476, 1977.

Abstract: The conclusion that can be drawn from data on observations of oil spills is that it is very difficult to make generalizations about the biological effects of petroleum in the marine environment. Each case study adds to appreciation of the complexity of the fate and effects of petroleum but frequently raises new and perplexing questions. Little reliable information is available on the basic ecology and physiology of almost all of the arctic marine species. Lack of reliable data makes it extremely difficult to predict the interaction of oil with arctic and subarctic marine ecosystems as most existing knowledge was gained for field and laboratory studies of temperate and tropical marine environments. DIALOG ASFA file 44

11. **Inputs, transport mechanisms, and observed concentrations of petroleum in the marine environment.**
Clark, R. C., Jr.; MacLeod, W. D. Jr. NOAA, National Marine Fisheries Service, Norwest and Alaska Fisheries Center, Seattle, WA 98112, USA. In: Effects of petroleum on Arctic and Subarctic marine environments and organisms. Volume 1: Nature and fate of petroleum, pp. 91-223, 1977.

Abstract: This chapter provides detailed information on potential petroleum hydrocarbon inputs from land-based discharges, marine operations, offshore production operations, oil seeps, and atmospheric input spill transport and related mechanisms from spreading, evaporation, dissolution, emulsification, agglomeration and sinking, microbial modification, photochemical modification, biological ingestion and excretion, tar ball formation and interaction of ice with petroleum and petroleum hydrocarbon levels in the marine environment such as in organisms, sediment, seawater, and tar balls. DIALOG ASFA file 44

12. **Observations of a cold-water intertidal community after 5 years of a low-level, persistent oil spill from the General M.C. Meigs. Presented at: Symposium on Recovery Potential of Oiled Marine Northern Environments Halifax (Canada) 10 Oct 1977. J. Fish. Res. Board Can.**
Clark, R. C., Jr.; Patten, B. G.; DeNike, E. E. Environ. Conserv. Div., Northwest and Alaska Fish. Cent., Nat. Mar. Fish. Serv., Seattle, WA 98112, USA. Canada. Fish. Res. Board. Journal, Vol.35, No. 5, pp. 754-765, 1978.

Abstract: A rich and productive intertidal community was exposed continually for over 5 yr to small quantities of a Navy Special fuel oil from the unmanned troopship General M.C. Meigs that came aground on the Washington coast in January 1972. Observations of animal and plant populations and their petroleum hydrocarbon uptake patterns showed early evidence of contamination and the persistence of the oil spill throughout the study period. Abnormal and dead urchins, and loss of algal fronds and pigment were observed in localized areas near the wreck for at least 1 yr. Within 2 months of the accident, paraffinic hydrocarbons had been taken up by prominent members of the community and continued to appear in certan species even after 5 yr. Although changes were seen in certain species during the early days of this persistent low-level pollution incident, the community balance in this rocky, intertidal ecosystem does not appear to have been markedly altered. DIALOG ASFA file 44

13. **Port Valdez environmental studies: 1976-1978.**
Colonell, J. M. Woodward-Clyde Consultants, Anchorage, AK 99501, USA. Proc. Am. Soc. Civ. Eng.; J. Environ. Eng. Div, Vol. 106 (EE5), pp. 907-917, 1980.

Abstract: All oily ballast water from the holds of tankers arriving at the Trans-Alaka Pipeline terminus in Valdez is pumped ashore for treatment before being discharged into Port Valdez. A 3-yr multidisciplinary program of studies was conducted to monitor the effect, if any, that this discharge would have upon the water quality and biota of Port Valdez. Consisting of 8 separate projects the program: extended substantially the baseline data for selected physical, chemical, and biological parameters and developed monitoring procedures as required to detect changes in the Port Valdez marine environment. The conclusion of these studies was that there had been no detectable impact during the term of this program on those elements of the environment that had been monitored prior to and following initiation of the treated ballast water discharge. DIALOG ASFA file 44

14. **THE RANDOM TRANSPORT OF OIL BY SEA ICE.**
Colony, R. POLAR SCI. CENTER, UNIV. WASHINGTON, SEATTLE, WASHINGTON, USA. INTERNATIONAL ASSOCIATION ON WATER POLLUTION RESEARCH AND CONTROL CONFERENCE ON ARCTIC WATER POLLUTION RESEARCH: APPLICATIONS OF SCIENCE AND TECHNOLOGY, YELLOWKNIFE, NORTHWEST. TERRIT., CANADA, APR. 28-MAY 1, 1985. WATER SCI TECHNOL, Vol. 18, No. 2, pp. 25-40, 1986.
DIALOG BIOSIS Previews File 5

15. **Microbial ecology studies of the Metula spill in the Straits of Magellan.**
Colwell, R. R.; Mills, A. L.; Walker, J. D. Univ. of Maryland, Dept. of Microbiology, College Park, MD 20742. CANADA. FISH. RES. BOARD. JOURNAL, Vol. 35, No. 5, pp. 573-580, May 1978.

Abstract: Degradation of oil spilled by the Metula tanker in the Magellan Straits by in situ physicochemical and biological mechanisms has proceeded slowly. Environmental studies conducted 2 yr after the 1974 spill found increased populations of heterotrophic and cold tolerant petroleum degrading bacteria at oil-impacted sites and marked oil persistence. The site is unique in that it is located in a cold region geographically similar to Southern Alaska and the Northeastern United States and never received any clean-up effort. The presence or absence

of oil residues in sampled sediments related to the amounts of heterotrophic and degrader bacteria, not sediment texture. Residues were extracted using a benzene-methanol mixture and separated on a alumina-packed column. Symposium on recovery potential of oiled marine northern environments. Recovery potential of oiled marine northern environments: symposium papers. Edited by J. C. Stevenson. DIALOG file 41

16. **Effects of oil contamination in the sea otter, Enhydra lutris.**
Costa, D. P.; Kooyman, G. L. Scripps Inst. Oceanogr., Physiological Res. Lab., La Jolla, CA 92093, USA. ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. FINAL REPORTS OF PRINCIPAL INVESTIGATORS. VOLUME 10 - BIOLOGICAL STUDIES, pp. 65-107, 1981.

Abstract: The objective of the study was to measure effects of crude oil contamination on sea otters through studies on the changes in the animal's physiology and behavior before and after contact with oil. A second objective was to attempt to rehabilitate the otters after crude oil contamination. The study has shown that small amounts of crude oil contamination have large effects on the metabolic rate of sea otters. Light oiling of approximately 25% of the animals' pelt surface area resulted in a 1.4X increase in metabolic rate while immersed in water at 15 degree C. Furthermore, when the oil was removed by detergent, the animal's metabolic rate increased 2.1X while immersed in water at 15 degree C. Of the three animals studied, two contracted pneumonia and one died. Studies upon free ranging sea otters have established that under certain conditions, sea otters can sustain low levels of oil contamination when 20% or less of the body surface is oiled. Rehabilitation of oil-fouled sea otters would be very costly requiring holding facilities to keep the animals for at least two weeks. Even if adequate facilities were available, the success rate of rehabilitating oil-fouled sea otters is likely to be rather low. RN: NOAA-OMPA-FR-81-10. DIALOG ASFA file 44

17. **Types of Potential Effects of Offshore Oil and Gas Development on Marine Mammals and Endangered Species of the Northern Bering Sea and Arctic Ocean. Technical paper no. 9 (Final).**
Cowles, C. J. ; Hansen, D. J. ; Hubbard, J. D. Bureau of Land Management, Anchorage, AK. Alaska Outer Continental Shelf Office., December 1981.

Abstract: The report summarizes information on the types of potential effects on marine mammals, endangered species, and rare plants which may be associated with oil and gas lease sales pending for the northern Bering Sea and arctic regions. The discussion does not imply that any specific level of impact will be sustained but rather identifies the various potential effects associated with offshore exploration, development, and production of petroleum hydrocarbon resources in the Alaska arctic regions.
RN: BLM-YK-TE-81-006.
NTIS Order No.: PB83-146142. DIALOG NTIS FILE 6

18. **HYDROCARBON BIOGEOCHEMICAL SETTING OF THE BAFFIN ISLAND OIL SPILL EXPERIMENTAL SITES CANADA II. WATER.**
Cretney, W. J.; Fowler, B. R.; Humphrey, B.; Fiest, D. L.; Boehm, P. D. INST. OCEAN SCI., PATRICIA BAY, DEP. FISH. OCEANS, P.O. BOX 6000, SIDNEY, B.C., CAN. V8L 4B2. ARCTIC, Vol. 40, Suppl. 1, pp. 66-70, 1987.

Abstract: A baseline for petroleum residues in the waters of the Cape Hatt region of Baffin Island in arctic Canada was obtained in anticipation of controlled oil releases of the Baffin Island Oil Spill (BIOS) Project. Total aliphatic and aromatic residues reflecting multiple sources were found to be in the low to sub .mu.g .cntdot. l-1 concentrations range. Alkylated naphthalenes, phenanthrenes and dibenzothiophenes were present in the sub ng .cntdot. l-1 concentrations range. The hydrocarbon baseline for the waters of the BIOS study area was found to be as low as might be found anywhere on earth and therefore ideally suited to the BIOS study. DIALOG BIOSIS Previews File 5

19. **HYDROCARBON BIOGEOCHEMICAL SETTING OF THE BAFFIN ISLAND OIL SPILL EXPERIMENTAL SITES CANADA I. SEDIMENTS.**
Cretney, W. J.; Green, D. R.; Fowler, B. R.; Humphrey, B.; Fiest, D. L.; Boehm, P. D. INST. OCEAN SCI., PATRICIA BAY, DEP. FISH. OCEANS, P.O. BOX 6000, SIDNEY, B.C., CAN. V8L 4B2. ARCTIC, Vol. 40, Suppl. 1, pp. 51-65, 1987.

Abstract: A baseline for petroleum residues in the sediments of the Cape Hatt region of Baffin Island in arctic Canada was obtained in anticipation of controlled oil releases of the Baffin Island Oil Spill (BIOS) Project. In subtidal sediments, the existing background of petroleum residues has an upper limit in the low to sub .mu.g .cntdot. g-1 concentration range. Petroleum was one of a variety of sources identified, including plant paraffin waxes and combustion products. Beach sediment hydrocarbons were quantitatively and qualitatively similar to those of subtidal sediments. The hydrocarbon baseline in sediments of the BIOS study area was found to be as low as might be found anywhere on earth and therefore ideally suited to the BIOS study. DIALOG BIOSIS Previews File 5

20. **Oil spill hazards and the salt marshes of Port Valdez, Alaska, and vicinity.**
Crow, J. H. Rutgers Univ., NCAS, New Brunswick, NJ 08903. American Association for the Advancement of Science: 144th national meeting American Association for the Advancement of Science, Feb. 12-17, 1978. Abstracts of papers. Edited by A. Herschman.

Abstract: In 1974 and 1975, baseline locations were selected for intensive study in the salt marshes of Port Valdez and vicinity. The sites were chosen over a wide area to reflect the impact of oil transport activities and to enhance the likelihood of oil spill documentation. Vegetation and soil characteristics were emphasized. Seventeen plant community complexes were identified, their habitats characterized, and utilized in evaluating susceptibility to oil spill damage. Marshes at Gold and Sawmill Creeks, both in Port Valdez, appear to be most vulnerable to major oil spill damage, but all marshes studied were threatened to some degree. Oil spills associated with seasonal high tides or winter, when fresh water outflow is minimal, increase the potential hazards to all the marshes. DIALOG file 41

21. **Methodology for environmental assessments of oil and hazardous substance spills. 14. European Marine Biological Symposium on "Protection of Life in the Sea", Helgoland (FRG) 23 Sep 1979.**
Davies, W. P.; Scott, G. I.; Getter, C. D.; Hayes, M. O.; Gundlach, E. R. Environ. Prot. Agency, Bears Bluff Lab., PO Box 368, Johns Island, SC 29455, USA. HELGOL. MEERESUNTERS., vol. 33, pp. 246-256, 1980.

Abstract: Ecological assessment of oil and hazardous material spills has been divided into three distinct phases: (1) first-order response studies - conducted at the time of the initial spill event, (2) second-order response studies - conducted two months to one year post-spill, which document any delayed mortality and attempt to identify potential sublethal impacts in sensitive species, and (3) third-order response studies - conducted one to three years post-spill, to document chronic impacts (both lethal and sublethal) to specific indicator species. First- and second-order response studies of the "Peck Slip" oil spill in Puerto Rico illustrate the usefulness of this method. DIALOG ASFA file 44

22. **THE EFFECTS OF OIL CONTAMINATION AND CLEANING ON SEA OTTERS ENHYDRA-LUTRIS II. METABOLISM THERMOREGULATION AND BEHAVIOR.**
Davis, R. W.; Williams, T. M.; Thomas, J. A.; Kastelein, R. A.; Cornell, L. H. SEAL WORLD RES. INST., HUBBS MARINE RES. CENT., 1700 S. SHORES ROAD, SAN DIEGO, CALIF. 92109. CAN. J. ZOOL., Vol. 66, No. 12, pp. 2782-2790, 1988.

Abstract: The purpose of this study was to develop a method to clean and rehabilitate sea otters (Enhydra lutris) that might become contaminated during an oil spill and to determine which physiological and behavioral factors were important in restoring the insulation provided by the fur. Tests were conducted on 12 sea otters captured in Alaska [USA] and brought to the Sea World Research Institute in San Diego [California]. Measurements of average metabolic rate, core body temperature, behavior, and squalene (the major lipid of sebum) concentration on the fur were made under three conditions: (i) before oiling (base line), (ii) 1-3 days after 20% of the body surface was covered with fresh crude oil, and (iii) after cleaning. Under base-line conditions in water at 13.degree. C, average metabolic rate was 8.0 W/kg, core body temperature was 38.9.degree. C, and whole body thermal conductance was 10.7 W/(m2 .cntdot. .degree. C). Otters spent 35% of their time grooming, 45% resting, 10% swimming, and 10% feeding. The squalene concentration on the fur averaged 3.7 mg/g fur. Oiling increased thermal conductance 1.8 times. To compensate for the loss of insulation and maintain a normal core body temperature (39.degree. C), the otters increased average metabolic rate (1.9 times) through voluntary activity and shivering; the time spent grooming and swimming increased 1.7 times. Using Dawn detergent, we were able to clean the oiled fur during 40 min of washing and rinsing. Grooming activity by the otters was essential for restoring the water-repellent quality of the fur. Core body temperature, average metabolic rate, and thermal conductance returned to base-line levels 3-6 days after cleaning. Squalene was removed by cleaning and did not return to normal levels in the oiled area after 7 days. Veterinary care was important to keep the otters healthy. At least 1-2 weeks should be allowed for otters to restore the insulation of their fur and for recovery from the stress of oiling and cleaning. DIALOG BIOSIS Previews File 5

23. **ICE CONDITIONS AT CAPE HATT BAFFIN ISLAND CANADA.**
Dickins, D. F. DF DICKINS ASSOC. LTD., 3732 WEST BROADWAY, VANCOUVER, B.C., CAN. V6R 2C1. ARCTIC, Vol. 40, Suppl. 1, pp. 34-41, 1987.

Abstract: The ice environment at Cape Hatt was studied to determine annual variations in ice break-up and freeze-up, which could affect the design, execution and results of the Baffin Island Oil Spill Project. Data from lapse camera stations, field observations and historical charts were used to compare the Cape Hatt ice regime with other arctic sites and to assess the potential for ice interaction with oiled intertidal sediments. The Cape Hatt area experience 63 days of open water in an average year and generally has a similar ice cycle to other inlets in the eastern Arctic. Ice deterioration begins in June, and the area is normally clear of ice by late July. Freeze-up begins in late September, and complete ice cover is established within a month of first ice formation. Given the 30% shorter open water period at Cape Hatt compared with more southerly arctic locations, the long-term oil weathering rates derived from the BIOS project can be considered conservative when applied to areas such as the Beaufort Sea. The summer of 1981 was characterized by an unusually long open water season, and ice did not hinder field operations associated with the experimental oil releases. The variability in open water seasons during subsequent summers will be an important factor in determining the long-term fate of oil stranded in Bay 11. The interaction of ice with the nearshore seabed was observed to play a major role in mixing and redistributing the upper layer of beach material ranging from fine silt to boulders. DIALOG BIOSIS Previews File 5

24. **Environmental atlas for Beaufort Sea oil spill response.**
Dickins, D.; Martin, L.; Bjerkelund, I.; Potter, S.; Erickson, D.; Harper, J.; Norton, P.; Johnson, S.; Vonk, P. Dickins (D.F.) Associates Ltd., Vancouver, British Columbia (Canada); ESL Environmental Sciences Ltd., Vancouver, British Columbia (Canada)., March 1987.

Abstract: The primary objective of the atlas is to provide a synthesis of environmental information relevant to the planning and implementation of year-round oil spill countermeasures in both coastal and offshore areas of the Beaufort Sea. The atlas is intended to be used as a link between the environmental characteristics of the region and the practical considerations of providing an effective response to marine oil spills, but not as an oil spill manual. This atlas was developed to meet the needs of industry, government, and local community groups for a document specifically related to offshore, year-round oil field development in the Beaufort Sea. The atlas is useful to assist in the development of the most effective contingency plans for a specific area to provide a source document on which to base realistic oil spill training exercises, and to act as a basic field reference to important environmental factors in an actual spill situation. The study area covers the southern Canadian Beaufort Sea from the United States/Canada border on the west to Bailie Islands on the east, the median location of the polar pack edge on the north and the backshore limits of potential contamination from a marine oil spill on the south. The sensitivity ranking is based on a total of 20 environmental elements ranked within the 3 categories

of human sensitivity, and shore zone oil residence or marine oil residence. 2 tabs., 11 refs.
RN: DA-8703. DIALOG DOE Energy file 103

25. **The distribution, abundance and feeding ecology of birds associated with pack ice.**
Divoky, G. J.; Good, A. E.; McElroy, T. L.; Stenzel, L. E.; Woodby, D. A. Point Reyes Brid Observ., Stinson Beach, CA 94970, USA. ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. ANNUAL REPORTS OF PRINCIPAL INVESTIGATORS FOR THE YEAR ENDING MARCH 1980. VOLUME 1: RECEPTORS - BIRDS, PLANKTON, LITTORAL, BENTHOS, pp. 110-141, 1980.

Abstract: Preliminary findings of the 1979 field season on Cooper Island and a preliminary analysis of Norton Sound coastal bird habitats is presented. Observations on Cooper Island showed that 1979 was a year when early ice breakup meant that no ice associated zooplankton was present near the island during the late summer migration. In previous years a pagophilic or other type of zooplankton buildup in the littoral zone was a major food source for migrating seabirds. Certain species were able to utilize patchy, short-lived food sources and remained in the Cooper Island area spending much of their time roosting. Other species were not seen in their usual numbers and they apparently were feeding in other areas. The areas where food is present thus becomes a critical habitat where human disturbance such as those arising from oil exploration could impact large numbers of birds.
RN:NOAA-OMPA-AR-80-1. DIALOG ASFA file 44

26. **Environmental Assessment of the Alaskan Continental Shelf, Northeast Gulf of Alaska Interim Synthesis Report.**
Science Applications, Inc., Boulder, CO., July 1980.

Abstract: This volume represents an interim edition of the Northeast Gulf of Alaska (NEGOA) Synthesis Report and is intended to present a multidisciplinary overview of information relevant to possible Alaskan Outer Continental Shelf oil and gas development. The program focuses on several lease areas, ranging from the subarctic Northeast Gulf of Alaska to the arctic Beaufort Sea. This current synthesis organizes all available marine environmental information pertinent to OCS development for the given lease area. It presents a picture of the operation and vulnerability of the environmental system.
Sponsored in part by Bureau of Land Management, Washington, DC.
NTIS Order No.: PB81-177883. DIALOG NTIS FILE 6

27. **Environmental Assessment of the Alaskan Continental Shelf: Final Reports of Principal Investigators. Volume 3 - Physical Science Studies.** National Oceanic and Atmospheric Administration, Boulder, CO. Office of Marine Pollution Assessment., October 1981.

Abstract: Current measurements in possible dispersal regions of the Beaufort Sea; Physical oceanographic and meteorological conditions in the Northwest Gulf of Alaska; Oil spill trajectory simulation Lower Cook Inlet - Shelikof Strait, Alaska; Wind field transition matrix analysis Lower Cook Inlet--Shelikof Strait, Alaska; Evaluation of CODAR Data Lower Cook Inlet, Alaska; The transport and behavior of oil spilled in and under sea ice.
Sponsored in part by Bureau of Land Management, Anchorage, Alaska.
NTIS Order No.: PB82-197351; see also PB81-225732. DIALOG NTIS FILE 6

28. **Environmental assessment of the Alaskan Continental Shelf. Final reports of principal investigators. Volume 18 - Biological studies.** National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div., May 1983.

Abstract: A compilation of two final reports dealing with the evolution, pathobiology, and breeding ecology of large gulls (Larus) in the Northeast Gulf of Alaska and effects of petroleum exposure on the breeding ecology of gulls and kittiwakes, and bird use of coastal habitats in Norton Sound.
NTIS Order No.: PB-85-247260/XAB. DIALOG DOE Energy file 103

29. National Ocean Serv., Anchorage, AK (USA). ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. FINAL REPORTS OF PRINCIPAL INVESTIGATORS. VOLUME 51, 787 pp, 1986.

Abstract: Research to determine the accumulation of organic constituents and heavy metals from petroleum-impacted sediments by marine detritivores of the Alaskan outer continental shelf Suspended particulate matter distribution, transport, and physical characteristics in the north Aleutian Shelf and St. George Basin lease areas The production and dispersion of dissolved methane in southeastern Bering Sea Oil spill vulnerability, coastal morphology, and sedimentation of outer Kenai Peninsula and Montague Island Circulation and water masses in the Gulf of Alaska Coastal oceanography of the northeastern Gulf of Alaska.
NTIS Order No.: PB87-198867/GAR. DIALOG ASFA file 44

30. **Effects of Prudhoe Bay crude oil on primary production and zooplankton in Arctic Tundra thaw ponds.**
Federle, T. W. ; Vestal, J. R. ; Hater, G. R. ; Miller, M. C. Cincinnati Univ., Biol. Sci. Dep., Cincinnati, OH 45221, USA. Mar. Environ. Res, Vol. 2, No. 1, pp. 3-18, 1979.

Abstract: The effects of Prudhoe Bay, Alaska, crude oil on the indigenous phytoplankton and zooplankton of tundra thaw ponds were studied under controlled conditions in situ during the summer of 1976. These effects were compared with uncontrolled oil spills on Pond Omega (a year previously) and Pond E (six years previously). In the uncontrolled spills, the phytoplankton species composition of both ponds remained appreciably different compared with control Pond C, although phytoplankton biomass did not differ greatly. Primary production remained low in Pond Omega but had recovered to control levels in Pond E. In controlled subpond experiments, oil caused a decrease of

about 90-100% in primary production in five days but recovered to 40-50% of the control level within fifteen days. During that time, phytoplankton biomass decreased initially but recovered within fifteen days. Oil caused a shift in phytoplankton species composition from a predominance of cryptophytes to chrysophytes. Subponds containing two Daphnia middendorffiana and one Brachinecta paludosa per litre of pondwater were also affected by oil, causing zooplankton death within three or four days. After that time, changes in the phytoplankton species composition were similar to control subponds without zooplankton. Oil toxicity to zooplankton or experimental removal resulted in a loss of grazing pressure which caused the elimination of the cryptophyte Rhodomonas sp. This species was still absent from Pond Omega, but was seen in Pond E for the first time, when zooplankton also reappeared after six years. Oil perturbation of tundra thaw ponds causes a loss of zooplankton and a reduction in primary production. Phytoplankton primary production recovers somewhat but algal species composition remains changed because of the loss of zooplankton grazing pressure and the selective effects of oil. DIALOG ASFA file 44

31. **Synthesis of effects of oil on marine mammals. Final report, 1986-1988.**
Geraci, J. R.; St, D. J. Battelle Memorial Inst., Ventura, CA (USA), September 1988.

Abstract: The report completes the synthesis of existing information on the effects of oil, dispersed oil, oil dispersants, and oil-cleaning agents on marine mammals which migrate through or inhabit U.S. Outer Continental Shelf (OCS) planning areas. The report will be used to produce a manuscript for use in OCS decision making and serve as a general-reference document for parties interested in marine mammals and oil-effects research. A literature search on foreign and non-foreign literature, was conducted on topics pertaining to the natural history and oil, oil dispersant, and oil-cleaning agents effects to marine mammals.
NTIS Order No.:PB-89-117451/XAB. DIALOG DOE Energy file 103

32. **A Discussion of Factors Influencing Dispersion of Pollutants in the Beaufort Sea.**
Giovando, L. F.; Herlinveaux, R. H. Institute of Ocean Sciences, Patricia Bay, Sidney B.C. (Canada). PAC. MAR. SCI. REP. (IOS), No. 81-4, 211 pp, 1981.

Abstract: A brief history is given of the geographic, hydrographic and oceanographic investigations that were carried out in the Beaufort Sea area during the past 150 years culminated in the Beaufort Sea Project of 1974-75. The information obtained is utilized to prepare a description of the general physical environment of the area, emphasis being placed on the physical oceanography. This description provides the basis for the consideration of four environmental situations (scenarios), each which could strongly influence in its own way, the general destiny of crude oil or other pollutants discharged into the Beaufort Sea. The advantages and disadvantages of the cold-region use of some oil-spill countermeasure techniques presently available are discussed. A summary of the expected general behaviour of pollutants entering the Beaufort Sea is given, together with some suggestions for further studies necessary to refine our insight into this behaviour. DIALOG ASFA file 44

33. **Importance of measuring microbial enzymatic functions while assessing and predicting long-term anthropogenic perturbations.**
Griffiths, R. P. Dep. Microbiol., Oregon State Univ., Corvallis, OR, USA. MAR. POLLUT. BULL, Vol. 14, No. 5, pp. 162-165, 1983.

Abstract: The studies outlined below were an attempt to quantify the impact of a pollutant (crude oil) on the microbial activities associated with major nutrient cycling in arctic and subarctic sediments. In addition, an assessment was made concerning the potential impact of this pollutant in a prospective lease area for offshore drilling. The general approach taken and a brief summary of the results are described to illustrate the feasibility of this approach in application to other pollution impact studies. DIALOG file 41

34. **Field Observations on the Acute Effect of Crude Oil on Glucose and Glutamate Uptake in Samples Collected From Arctic and Subarctic Waters.**
Griffiths, R. P.; McNamara, T. M.; Caldwell, B. A.; Morita, R. Y. Dept. Microbiol. & Sch. Oceanogr., OR St. Univ., Corvallis, OR. APPL. AND ENVIRON. MICROBIOL., Vol. 41, No. 6, pp. 1400-1406, 1981.

Abstract: The acute effects of crude oil on glucose uptake rates by marine microorganisms were studied in 215 water and 162 sediment samples collected from both arctic and subarctic marine waters. The mean percentage reduction of glucose uptake rates ranged from 37 to 58 in the water samples exposed to crude oil and from 14 to 36 in the sediment samples. Substrate uptake kinetic studies indicated that the observed reductions by microbial populations exposed to crude oil were caused by metabolic inhibition. DIALOG file 41

35. **Study of microbial activity and crude oil-microbial interactions in the waters and sediments of Cook Inlet and the Beaufort Sea.**
Griffiths, R. P.; Morita, R. Y. Oregon State Univ., Dep. Microbiol., Corvallis, OR 97331, USA. ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. ANNUAL REPORTS OF PRINCIPAL INVESTIGATORS FOR THE YEAR ENDING MARCH 1980. VOLUME 2: RECEPTORS -- MICROBIOLOGY ECOLOGICAL PROCESSES, pp. 224-464, 1980.

Abstract: In each geographic area studied, various microbial functions related to the overall productivity of the respective ecosystems were measured. It was found that crude oil alters microbial function in marine sediments. This altered function has three major impacts on normal flow of food through the detrital food chains. Crude oil interferes with the process that converts nitrogen and phosphorus that is tied up in organic material into inorganic nitrogen and phosphorus that is required for plant growth. Crude oil changes microbial activity in the sediments so that the chemical environment of the sediment surface is changed. The studies also indicate that the greatest impact would be found in areas where crude oil became incorporated into fine grained marine sediments. This would be of particular importance in inshore sediments where the microbial activity is unusually high or in

areas where most of the inorganic nutrients required for algae growth is generated locally by bacterial activity. RN:NOAA-OMPA-AR-80-2. DIALOG ASFA file 44

36. **Study of microbial activity and crude oil-microbial interactions in the waters and sediments of Cook Inlet and the Beaufort Sea.**
Griffiths, R. P.; Morita, R. Y. Oregon State Univ., Dep. Microbiol., Corvallis, OR 97331, USA. ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. FINAL REPORTS OF PRINCIPAL INVESTIGATORS. VOLUME 10 - BIOLOGICAL STUDIES, pp. 417-784, 1981.

Abstract: It has been found that crude oil alters microbial function in marine sediments. This altered function will have three major impacts on normal biological activity. (1) It will reduce overall productivity by interfering with the normal flow of food through the detrital food chain. Recent estimates show that 50-80% of food available to all animals present is ultimately derived from this source. (2) Crude oil will interfere with the processes that convert the nitrogen and phosphorous in organic material into inorganic forms which are required for plant growth. Without these inorganic nutrients, plants can not produce the new organic material required to feed the animals present. (3) Crude oil changes microbial activity in the sediments so that the chemical environment of the sediment surface is changed. It seems quite likely that these changes will remain long after the initial crude oil toxicity has abated and could greatly alter the normal recruitment of animals back into the impacted area. It is believed the most vulnerable environment in Alaskan marine systems is the soft-fine grained sediments such as those found in the St. Georges Basin in the southern Bering Sea, Shelikof Strait, and the major bays of Cool Inlet. These are the regions predicted to have the greatest long-term perturbation in the case of a large scale oil spill.
RN:NOAA-OMPA-FR-81-10. DIALOG ASFA file 44

37. **Potential Effects of Oil Spills and Other Chemical Pollutants on Marine Mammals Occurring in Alaskan Waters.**
Hansen, D. J. Minerals Management Service, Anchorage, AK. Alaska Outer Continental Shelf Office., 1985.

Abstract: The outer continental shelf report describes and assesses the potential effects of oil spills and other contaminants on marine mammals that occur in Alaskan waters, assuming that a spill or contamination occurs. The report focuses primarily on the potential direct and indirect effects of oil spills on marine mammals and addresses both short-term effects that may occur at the time of contact with oil, and long-term effects that may occur long after contact with oil. The report also briefly reviews the literature on the potential effects of other contaminants such as heavy metals and organochlorines (DDT and PCB's) on marine mammals. The assessment concludes that sea otters, polar bears, fur seals, and very young seal pups could suffer serious or lethal effects if contact with oil occurred.
RN: MMS/AK/TE-85/002; OCS/MMS-85/0031.
NTIS Order No.: PB85-231496/XAB. DIALOG NTIS FILE 6

38. **Fish and Offshore Oil Development.**
Hay, K. G. API REPORT, UNDATED (84) ASSN REPORT

Abstract: WITH THE INCREASING EXPLORATION OF U.S. OFFSHORE AREAS FOR OIL AND GAS, THERE IS CONTINUING CONCERN ABOUT OPERATIONAL IMPACTS ON FISHERY RESOURCES. QUESTIONS FREQUENTLY ASKED BY FISHERMEN ARE COMPILED, AND ANSWERS ATTEMPT TO ADDRESS IMPORTANT ENVIRONMENTAL CONSIDERATIONS ASSOCIATED WITH OFFSHORE OIL DEVELOPMENT. OFFSHORE LEASING POLICIES AND HYDROCARBON RESOURCES ARE REVIEWED. SEISMIC EXPLORATION ACTIVITIES HOLD NO DANGER FOR FISH POPULATIONS. THE EFFECTS OF OIL SPILLS ON FISH ARE SUMMARIZED, AS ARE IMPACTS RELATED TO DRILLING MUD DISCHARGES AND DRILLING DEBRIS. (13 DIAGRAMS, 2 GRAPHS, 19 REFERENCES,). DIALOG ENVIROLINE File 40

39. **Effects of crude oils on the growth of arctic marine phytoplankton.** Hsiao, S. I. C. Arctic Biol. Stn., Dep. Fish. and the Environ., Fish. and Mar. Serv., PO Box 400, Ste. Anne de Bellevue, PQ, H9X 3L6, Canada. Environ. Pollut, Vol. 17, No. 2, pp. 94-107, 1978.

Abstract: Growth responses of arctic marine phytoplankton to crude oils were determined at various temperatures and exposures in a defined medium at constant light energy. The growth of diatoms (Chaetoceros septentrionalis, Navicula behusiensis and Nitzschia delicatissima) was inhibited by Atkinson Point, Norman Wells, Pembina and Venezuela crude oils after ten days' exposure at a concentration of 10 ppm at 0 C, 5 C and 10 C. Growth of the green flagellate Chlamydomonas pulsatilla was stimulated by Norman Wells and Pembina crude oils at 0 C. Growth of both diatoms and the green flagellate was markedly inhibited by oil concentrations higher than 100 ppm but diatoms were more severely impaired than the green flagellate. Greater inhibition generally occurred with longer exposure at temperatures between 5 C and 10 C than at 0 C. Chlamydomonas was not killed by any of the crude oils at the concentrations, temperatures and lengths of exposure tested. Lethal effects among diatoms varied with species, types of oil, temperatures and exposure time. Relative species sensitivity of the phytoplankton to the oils was determined based on percentage survival, exponential growth rate and generation time. Chlamydomonas was the most tolerant species and had a greater ability to resume growth, while diatoms were sensitive and had little or no ability to resume growth. Possible ecological consequences of such species sensitivity and differential growth are discussed. DIALOG ASFA file 44

40. **Effects of crude oils and the oil dispersant Corexit on primary production of arctic marine phytoplankton and seaweed.**
Hsiao, S. I. C.; Kittle, D. W.; Foy, M. G. Arctic Biol. Stn., Environ. Canada, Fish. and Mar. Serv., PO Box 400, Ste. Anne de Bellevue, P.Q., Canada. Environ. Pollut., Vol. 15, No. 3, pp. 209-221, 1978.

Abstract: Effects of crude oil and Corexit on primary production of arctic marine phytoplankton were studied in situ. The production rate varied with types and concentrations of crude oil, method of preparation of oil-seawater mixtures, environmental conditions and species composition of each sample tested. In samples with the same species composition, inhibition of production generally increased with increasing oil concentration. The crude oil-Corexit mixtures were more toxic than crude oil or Corexit alone. In situ primary production of the seaweeds, Laminaria saccharina (L.) Lamouroux and Phyllophora truncata (P.) Newroth et Taylor was significantly inhibited by all types and concentrations of oil tested. DIALOG ASFA file 44

41. **Environmental Assessment of the Alaskan Continental Shelf: Final Reports of Principal Investigators. Volume 16 - Biological Studies.**
Hunt, G. L. ; Kaiwi, J.; Schneider, D.; Sanger, G. A. ; Patten, S. M. National Oceanic and Atmospheric Administration, Rockville, MD. Office of Marine Pollution Assessment, January 1982.

Abstract: Contents: Pelagic distribution of marine birds and analysis of encounter probability for the Southeastern Bering Sea; The winter feeding ecology and trophic relationships of marine birds in Kachemak Bay, AK; Seasonal use of coastal habitat from Yakutat Bay to Cape Fairweather by migratory seabirds, shorebirds and waterfowl.
Sponsored in part by Bureau of Land Management, Washington, DC.
NTIS Order No.: PB82-185653; see also Volume 13, PB82-185646. DIALOG NTIS FILE 6

42. **Petroleum in coastal environments: What do we know?.**
Ludwig, D. F.; Womack, C. J.; Jordan, S. J.; Bell, W. Address not stated. THE FATE AND EFFECTS OF POLLUTANTS: A SYMPOSIUM, (April 26-28, 1985).

Abstract: As part of an ongoing review of literature pertinent to potential environmental effects of offshore petroleum rights leasing, 1196 key references have been assembled (to date). This data base consists of recent material from a variety of sources, including various map series, government documents, referred journals, review volumes, and symposia papers. The data base is reasonably representative of available information, and with this as an assumption, analysis of the catalogue suggests regional topics that require additional study, are controversial and/or critically important, or have been sufficiently reported. Preliminary analysis of the data base indicates that the Atlantic, Pacific, and parts of the southern Alaskan coasts have been thoroughly investigated, and that the U.S. Gulf of Mexico coast, despite its developed drilling industry, is deficient in ecological study.
TECH. REP. MD. UNIV. SEA GRANT PROGRAM. DIALOG file 41

43. **Emissions from in situ burning of crude oil in the Arctic.**
MacKay, D.; Day, T.; Nadeau, S.; Thurier, R. Univ. of Toronto, Dept. of Chemical Eng. and Applied Chemistry, Toronto, Ontario M5S 1A4, Canada. WATER, AIR, AND SOIL POLLUTION, Vol. 11, No. 2, pp. 139-152, February 1979.

Abstract: The results of an exploratory study of the effects of in situ crude oil spill burning on air quality in the Beaufort Sea region of the Arctic are presented. The amounts of oil released, the size and number of burnable oil pools, and the duration of the burning period are postulated in a scenario. Emissions of soot, CO, SO2, and metals are estimated for locations close to the fire and at 10 and 40 km. Assumptions are made about plume rise and dispersion which permit downwind concentrations of emissions to be calculated and compared with air quality objectives. Although the calculated concentrations may contain significant error because of the assumptions, the data demonstrate that SO2 and CO concentrations will be acceptably low and soot and metals concentrations will often be undesirably high within 10 km of the fires but will be acceptably low at greater distances. Burning may be a method of substantially reducing the adverse environmental impact of oil spills in the Arctic. DIALOG file 41

44. **The physical and chemical fate of spilled oil. In: Petroleum effects in the Arctic Environment, edited by Engelhardt, F. R.**
Mackay, D.; Engelhardt, F. R. Institute for Environmental Studies, Univ. of Toronto., 1985.

Abstract: As petroleum reserves in more temperate and accessible regions become depleted, increasing attention is being focused on the arctic sedimentary basins as future sources of supply of crude oil and natural gas. The discovery of substantial crude oil reserves at Prudhoe Bay, Alaska, has resulted in increased exploration, in the development of conceptual plans for production and transportation facilities, and in a growing awareness by the public, governments and industry that these plans for exploitation could ultimately result in chronic and episodal contamination of arctic ecosystems by oil. The prospect that incidents such as the Amoco Cadiz grounding or the Ixtoc blowout could be repeated in the Arctic raises questions such as the following: In this chapter the authors address the issues and suggest some answers to the questions. There is, of course, a series of further questions on the biological, ecological and social impacts of oil spills, which are treated in other chapters. It can be argued that these further issues can only be addressed effectively if there is a firm understanding of the basic physics and chemistry of oil spills. DIALOG DOE Energy file 103

45. **EFFECTS OF SHORT-TERM EXPOSURE TO DISPERSED OIL IN ARCTIC INVERTEBRATES.**
Mageau, C.; Engelhardt, F. R.; Gilfillan, E. S.; Boehm, P. D. NORTH. ENVIRON. DIRECTORATE, INDIAN AND NORTH. AFFAIRS, LES TERRASSES CHAUDIERE, OTTAWA, ONTARIO, CANADA K1A OH4. ARCTIC, Vol. 40, Suppl. 1, pp. 162-171, 1987.

Abstract: A series of experimental studies was carried out as part of the Baffin Island [Canada] Oil Spill (BIOS) Project to define the behavioural, physiological and biochemical reactions of three arctic marine benthic invertebrate species exposed to chemically dispersed crude oil. Behavioural responses and patterns of hydrocarbon

accumulation and release observed in the bivalves and the urchin during the 1981 field spill were similar to those observed during the laboratory simulations. Ostial closure, loss of responsiveness to mechanical stimuli and narcosis were characteristic of the bivalves. Exposed urchins displayed a functional loss of the tube foot and spine behaviour. Detailed hydrocarbon analysis indicated different uptake dynamics among the species. The effects of dispersed oil were immediate and short lived and resulted in temporary accumulation of hydrocarbons. Depuration of these stored hydrocarbons occurred during the experimental recovery period. In vivo biodegradation of hydrocarbons was indicated in the bivalves. Physiological parameters measured in bivalves exposed to oil included elements of scope for growth, activity of aspartate aminotransferase and glucose-6-phosphate dehydrogenase. Dose-response relationships between physiological rates and hydrocarbon body burden were apparent. DIALOG BIOSIS Previews File 5

46. **Coastal zone '87.**
Magoon, O. T.; Converse, H.; Miner, D.; Tobin, L. T.; Clark, D.; Domurat, G. 5. symposium on coastal and ocean management, 1987.

Abstract: This book contains over 100 selections. Some of the titles are: Chasing Birds from Oil Spills - Two Experiments; Global Issues - Local Responsibilities; A Coastal Management Program for the Saudi Arabian Red Sea Coast; Oil-Native Conflicts - Solutions for the Beaufort Sea; Ocean Space Encompassed by Oil and Gas Activities; Exploration for Oil and Gas on the Arctic National Wildlife Range, Coastal Plain, Alaska; and OTEC - At the Brink of Commerical Reality.
RN: CONF-870502-. DIALOG DOE Energy file 103

47. **Results of the 1984-85 National Benthic Surveillance Project: West Coast. Oceans '86 "Science-Engineering-Adventure" Washington, DC (USA) Sep. 23-25, 1986.**
Malins, D. C.; Chan, S.-L.; MacLeod, W. D., Jr.; McCain, B. B.; Clark, R. C., Jr.; Brown, D. W.; Myers, M. S.; Krahn, M. M. Environ. Conserv. Div., Northwest and Alaska Fish. Cent., NMFS, Seattle, WA 98112, USA. OCEANS '86 CONFERENCE RECORD: SCIENCE-ENGINEERING-ADVENTURE. VOL. 2. DATA MANAGEMENT, INSTRUMENTATION AND ECONOMICS, pp. 566-571, 1986.

Abstract: Bottomfish and sediments were collected from 18 sites including a number of reference sites on the U.S. West Coast during the first year of the multiyear National Benthic Surveillance Project. Sediments and fish were analyzed for toxic chemicals, and fish were examined for diseases. Wide variations in the concentrations of aromatic hydrocarbons (AH), polychlorinated biphenyls (PCB), DDT and related compounds, and selected metals in sediments were found within locations (i.e., embayments in the vicinity of major cities) and between locations. Prevalences of diseases (i.e., fin erosion and liver lesions) were usually highest in fish exposed to the highest levels of environmental contaminants.
English 8702. DIALOG ASFA file 44

48. **Sublethal effects of petroleum hydrocarbons and trace metals, including biotransformations, as reflected by morphological, chemical, physiological, pathological, and behavioral indices.**
Malins, D. C.; Hidgins, H. O.; McCain, B. B.; Weber, D. D.; Varanasi, U.; Brown, D. W. Natl. Mar. Fish. Serv., Northwest & Alaska Fish. Cent., Seattle, WA 98112, USA. ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. ANNUAL REPORTS OF PRINCIPAL INVESTIGATORS FOR THE YEAR ENDING MARCH 1980. VOLUME 3: EFFECTS, CONTAMINANT BASELINES, pp. 13-79, 1980.

Abstract: Results of this program have implications with respect to petroleum effects on aquatic species and consequently to OCS oil and gas development. The studies were designed as laboratory experiments on oil exposures of marine organisms in flowing-seawater tanks. Pink and chum salmon fry spend several months in coastal estuaries before going to sea and at this life stage they are extremely vulnerable to predation by other salmonid fishes. Predator-prey studies are in progress.
RN:NOAA-OMPA-AR-80-3. DIALOG ASFA file 44

49. **A biologist looks at oil in the sea.**
Mann, K. H. Dalhousie Univ., Dept. of Biology, Halifax, N.S. B3H 4J1, Can. SHORE AND BEACH, Vol. 46, No. 4, pp. 27-29, October 1978.

Abstract: Oil contamination of highly productive inshore waters results in varying degrees of damage, depending on the type of oil and the type of community living there. In temperate water the recovery time for coastal communities is about 10 yr, during which time much of the oil is consumed by microorganisms and converted to carbon dioxide or is buried in sediments, but because biological decomposition of oil and recolonization are slower in colder waters, recovery for oiled arctic waters may be much longer than 10 yr. Short growth seasons for plants, low temperatures, and long periods of ice cover also contribute to community stress by affecting species diversity, already lowered by the oil contamination. DIALOG file 41

50. **A DESCRIPTION OF ARCTIC NEARSHORE MEIOBENTHOS FROM OILED AND UNOILED SEDIMENTS AT CAPE HATT NORTHERN BAFFIN ISLAND CANADA.**
Martin, C. M.; Cross, W. E. LGL LTD., ENVIRON. RES. ASSOCIATES, 22 FISHER ST., P.O. BOX 280, KING CITY, ONTARIO LOG 1KO. CAN. TECH. REP. FISH. AQUAT. SCI., (1468), I-IV, 1-24, 1986.

Abstract: Benthic meiofauna from shallow nearshore waters at Cape Hatt, northern Baffin Island, were dominated by nematodes (68.4% of individuals collected), foraminiferans (10.1%), and copepods (7.7%). Densities were high (overall average of 582.5 individuals .cntdot. cm-2) relative to most other Arctic and boreal locations studied.

Analyses of variance revealed several types of systematic variability in the densities of dominant meiofaunal groups: variability among depths, bays, and years. Possible effects of oil released during the Baffin Island Oil Spill (BIOS) project in 1981 were indicated in a posteriori comparisons between reference bays and one bay where sediment oil concentrations were elevated. In the oiled bay, (1) nematode densities were lower than in four other bays during 1982, (2) copepod densities decreased at 6 m depth between 1982 and 1983, and (3) depth distributions of ostracods and foraminiferans differed from those in the reference bay in 1983. Each of these differences was consistent with differences in measured (or presumed) oil concentrations among depths, bays, and years. However, the lack of pre-spill data and replicated oil treatments precludes unequivocal conclusions: factors other than oil (e.g. substrate or exposure) may have been responsible for the observed patterns of distribution. Mean nematode:copepod (N/C) ratios and among-replicate variability in those values were high in two reference bays but not in the oiled bay, supporting recent evidence that N/C ratios are not reliable pollution indicators. DIALOG BIOSIS Previews File 5

51. **METEOROLOGICAL OPERATIONS AT CAPE HATT CANADA IN SUPPORT OF THE BAFFIN ISLAND OIL SPILL PROJECT.**
Meeres, L. S. 1003, 10160-115 ST., EDMONTON, ALBERTA, CAN. T5K 1T6. ARCTIC, Vol. 40, Suppl. 1, pp. 42-50, 1987.

Abstract: Climatological records for Pond Inlet and Arctic Bay indicate that the climate of the northern Baffin Island area lies between the cold, dry climate of the central Arctic and the slightly milder and moister climates of the western Beaufort Sea and the southeastern Baffin Island and Hudson Strait areas. A weather station was set up at Cape Hatt in late May 1980 to provide climatological data at the site of the Baffin Island Oil Spill Project. Daily precipitation and temperatures, hourly winds, rate of rainfall and hourly global solar radiation were measured. The station operated from late May to late June and from mid-July to the end of September in 1980 and from mid-July to early September in 1981. Temperature and precipitation data from the station were compared with those from Pond Inlet for the identical periods. Six outlying stations measured winds at representative locations in the area. Hour by hour comparisons were made of the winds at five shoreline stations with those at the camp station and those on a nearby mountain. These were used as one of the tools in forecasting winds for the oil releases. The weather forecasting system utilized one meteorologist at the site using weather charts and briefings from the Atmospheric Environment Service Arctic Weather Centre at Edmonton. The forecasts provided met all requirements for timing and accuracy. DIALOG BIOSIS Previews File 5

52. **Multivariate Analysis of Petroleum, Weathering in the Marine Environment-Sub Arctic. Appendices.** National Ocean Serv., Anchorage, AK (USA). Ocean Assessments Div. ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. FINAL REPORTS OF PRINCIPAL INVESTIGATORS. VOLUME 22 - APPENDICES, 209 pp, 1984.

Abstract: The report is: appendices to a final report entitled "Multivariate Analysis of Petroleum, Weathering in the Marine Environment-Sub Arctic". These appendices contain code listings and use information for the weathering model, provide detailed descriptions of analytical methods, and results of x-ray diffraction analyses of suspended particulate matter samples.
NTIS Order No.: PB85-215739/GAR. DIALOG ASFA file 44

53. **OIL-SPILL-RESPONSE MEASURES FOR OFFSHORE OIL AND GAS OPERATIONS.**
Murrell, T. L.; Levine, J. R.; Regg, J. B.; Tennyson, E. J. US MINERALS MANAGEMENT SERVICE REPORT 87-0062, April 1987.

Abstract: OIL SPILL RESPONSE CAPABILITIES ARE EXAMINED FOR ARCTIC AND SUBARCTIC OUTER CONTINENTAL SHELF (OCS) AREAS. THE RESPONSIBILITY TO PROTECT THE MARINE ENVIRONMENT FROM OIL POLLUTION IS ESTABLISHED BY THE OCS LANDS ACT OF 1978. U.S. MINERALS MANAGEMENT SERVICE JUDGES THE ADEQUACY OF LEASEES' SPILL RESPONSE PREPAREDNESS AND REQUIRES OPERATORS TO PROVIDE TRAINING AND OIL SPILL RESPONSE EXERCISES. VARIOUS SPILL RESPONSE MEASURES IDENTIFIED FOR USE OFFSHORE ALASKA ARE EMPHASIZED. THESE INVOLVE EFFORTS IN EIGHT MAJOR CATEGORIES: DETECTION, CONTAINMENT, RECOVERY, IN SITU BURNING, CHEMICAL APPLICATION, SHORELINE CLEANUP, WILDLIFE PROTECTION AND REHABILITATION, AND DISPOSAL. EQUIPMENT AND PROCEDURES HIGHLIGHTED ARE OIL BOOMS, SKIMMER SYSTEMS, CHEMICAL DISPERSANTS, SHORELINE CLEANUP VIA DIRECT SUCTION OR IN SITU BURNING, AND DISPOSAL VIA INCINERATORS, DISPERSION, OR IN SITU BURNING. (3 GRAPHS, 99 REFERENCES, 8 TABLES). DIALOG ENVIROLINE File 40

54. **HISTOPATHOLOGIC AND BIOCHEMICAL RESPONSES IN ARCTIC MARINE BIVALVE MOLLUSCS EXPOSED TO EXPERIMENTALLY SPILLED OIL.**
Neff, J. M.; Hillman, R. E.; Carr, R. S.; Buhl, R. L.; Lahey, J. I. BATTELLE OCEAN SCI., 397 WASHINGTON ST., DUXBURY, MASS. 02332, U.S.A. ARCTIC, Vol. 40, Suppl. 1, pp. 220-229, 1987.

Abstract: Following two experimental spills of chemically dispersed and undispersed crude oil in shallow bays on the northwest coast of Baffin Island. Canadian Arctic, the bivalve molluscs Mya truncata and Macoma calcarea accumulated significant amounts of petroleum hydrocarbons in bays receiving dispersed oil and in those receiving crude oil alone (Boehm et al., 1987). Following the spills, Mya released accumulated hydrocarbons more rapidly than Macoma. Specimens of Mya truncata and Macoma calcarea for histopathologic examination were collected immediately before, immediately after and one year after the experimental oil spills. Immediately after the spill there was an increased incidence of gill and digestive tract necrosis in Mya from the bays receiving chemically dispersed oil (Bays 7, 9 and 10). This was accompanied by an increase in the number of mucus cells in the digestive tract epithelium. After one year a few clams had granulocytomas throughout the tissues. Three clams from Bay 11 (receiving oil alone) collected one year after the spill had invasive neoplasias (probably cancer). One clam collected from Bay 7 immediately after the spill had a similar lesion. There were few lesions in Macoma from Bays 7 and 9 immediately after or one year after the spill. One year after the spill, animals from Bay 11 had a high incidence of vacuolization of the digestive tubule epithelum. The incidence of parasitism and hemocytic infiltration also was higher in Macoma from Bay 11 than from the other bays. One specimen had a blood neoplasm.

Clams Mya truncata were collected for biochemical analysis immediately before, immediately after and about two weeks after the simulated oil spills. Concentrations in the clam tissues of glucose, glycogen, trehalose, total lipid and free amino acid were measured. Concentrations and ratios of free amino acids in adductor muscles were the most useful indices of pollutant stress. The results of the biochemical analyses indicate that Mya from the four bays were not severely stressed by either dispersed oil or oil alone. Immediately after the spill, clams from the two major dispersed oil bays, and particularly Bay 10, appeared to be more severely than clams from Bay 11. After two weeks, clams from the dispersed oil bays, were nearly normal, while those from the bay receiving oil alone appeared stressed. These results seem to corroborate results from analytical chemistry and histopathology: that the acute effects of dispersed oil are greater than those of undispersed oil, but effects of undispersed oil on infaunal molluscs develop more slowly and persist longer than those from dispersed oil. DIALOG BIOSIS Previews File 5

55. **DISPERSANT USE GUIDELINES FOR COOK INLET, ALASKA.**
O'Brien, P.; Manen, C.; Hahn, B.; Metsker, H.; Fox, L.; Kennedy, D.; Getter, C. ALASKA DEPT ENV CONSERVATION,. ENV CANADA 9TH ARCTIC MARINE OILSPILL TECHNICAL SEMINAR, EDMONTON, JUN 10-12, 1986, p. 581 (20)

Abstract: DRAFT GUIDELINES FOR DISPERSANT USE IN COOK INLET, AK, ARE SUMMARIZED. THE DISPERSANT USE CRITERIA DEVELOPED FOR THE STATE CLASSIFY COASTAL WATERS INTO THREE DISPERSANT USE ZONES. IN ALL CASES, THE USE OF DISPERSANTS WILL BE BASED ON THE DETERMINATION THAT THE IMPACT OF DISPERSANTS OR DISPERSED OIL WILL BE LESS HARMFUL THAN NON-DISPERSED OIL. ZONE 1 IS DEFINED AS AN AREA IN WHICH DISPERSANT USE SHOULD BE CONSIDERED AS A MEANS TO PREVENT OR REDUCE THE AMOUNT OF OIL REACHING THE SHORELINE OR OTHER SENSITIVE RESOURCES. THE USE OF DISPERSANTS IN ZONE 2 IS CONDITIONAL IN ORDER TO PROTECT SENSITIVE WILDLIFE AND OTHER RESOURCES. DISPERSANT USE IS NOT RECOMMENDED IN ZONE 3. (1 DIAGRAM, 2 GRAPHS, 10 REFERENCES, 3 TABLES). DIALOG ENVIROLINE File 40

56. **DEPRESSION OF FEEDING AND GROWTH RATES OF THE SEA-STAR EVASTERIAS-TROSCHELII DURING LONG-TERM EXPOSURE TO THE WATER-SOLUBLE FRACTION OF CRUDE OIL.**
O'Clair, C. E.; Rice, S. D. NORTHWEST AND ALASKA FISHERIES CENTER, AUKE BAY LAB., NATL. MARINE FISHERIES SERVICE, NOAA, P.O. BOX 210155, AUKE BAY, ALASKA 99821. MAR. BIOL. (BERL), Vol. 84, No. 3, pp. 331-340, 1985.

Abstract: To test the effect of pretroleum hydrocarbon on predation by the seastar E. troschelii (Stimpson, 1862) on the mussel Mytilus edulis (L.), predator and prey were exposed to 6 concentrations of the water-soluble fraction (WSF) of Cook Inlet crude oil. Seastars and mussels were collected at Auke Bay, Alaska [USA], in Nov. 1980. During a 28 day exposure in a flow-through system, seastars were more senstive to the WSF than mussels: the LC50 for the seastars was 0.82 pm at day 19 and, although no mussels were exposed to WSF for > 12 days, none died. Daily feeding rates (whether in terms of number of mussels/seastar/day or dry wt of mussels/seastar/day) were significantly reduced at all concentrations > 0.12 ppm. At 0.20,0.28 and 0.72 ppm WSF, daily feeding rates (in terms of dry wt of mussels) were, respectively, 53, 37 and 5% of the control rate; at the 2 highest concentrations (0.97 and 1.31 ppm WSF), the seastars did not feed. Seastars at concentrations > 0.12 ppm WSF grew slower than individuals from the control group and the 0.12 ppm-treatment group combined. These laboratory results showed that E. troschelii is more sensitive to chronic low levels of the WSF of crude oil. The possibility that such oil pollution could reduce predation and permit M. edulis to monopolize the low interdistal zone of southern Alaska remains to be studied. DIALOG BIOSIS Previews File 5

57. **OCS (Outer Continental Shelf) oil and gas - an environmental assessment. Volume 5 - Potential biological effects of hypothetical oil discharges in the Atlantic Coast and Gulf of Alaska.** Council on Environmental Quality, Washington, DC (USA), April 1974.

Abstract: The report is an analysis of the primary biological effects of potential oil discharges resulting from hypothetical oil production activity on the Atlantic/Alaskan OCS. The results are intended for input to the Council on Environmental Quality as part of the information base to decide: (1) whether or not to recommend OCS oil exploration/drilling in these areas; and (2) if yes, where. Although emphasis is placed on analysis of impacts and recovery from large-volume infrequent accidental oil spills, small volume continuous discharges of hydrocarbons are also considered. Effects of oil releases from offshore platforms and spills occurring at coastal terminals are assessed.
NTIS Order No.: PB-86-216389/XAB. DIALOG DOE Energy file 103

58. **Oil Spills: Biological Effects. June 1981-February 1988 (Citations from the NTIS DATABASE).** National Technical Information Service, Springfield, VA., March 1988.

Abstract: This bibliography contains citations concerning the biological and ecological effects of oil spills. The effects on microorganisms, plants, and animals are studied. Damage assessment, ecological modeling, and environmental impact statements are included. (This updated bibliography contains 152 citations, 29 of which are new entries to the previous edition.).
NTIS Order No.: PB88-858931XSP; supersedes PB82-810391.

59. **Oil Spills: Environmental Effects. 1977-May 1986 (Citations from the Selected Water Resources Abstracts Database). Supt. for 1977-May 86.** National Technical Information Service, Springfield, VA, May 1986.

Abstract: This bibliography contains citations concerning environmental impacts from oil spills primarily resulting from ship wrecks and oil drilling and exploration. Oil spills in temperate, tropic and arctic zones which affect fresh, estuary, and marine waters are included. Cleanup operations and priorities, computer modeling and simulation analysis, oil spill investigations, and predicted movement of oil slicks in high traffic shipping lanes are among

the topics discussed. Microbial degradation of oils, and testing of oil and oil dispersant toxicity to aquatic plant and animal life are considered. (This updated bibliography contains 311 citations, 11 of which are new entries to the previous edition.).
Supersedes PB85-860559.; Prepared in cooperation with Office of Water Research and Technology, Washington, D.C.
NTIS Order No.: PB86-867447/XAB. DIALOG NTIS FILE 6

60. **COMPARATIVE STUDIES OF PHYTOTOXICITY AND CHEMICAL COMPOSITION OF AQUEOUS OIL SOLUTIONS AFFECTED BY EVAPORATION ILLUMINATION AND EXTRACTION.**
Ostgaard, K.; Aaberg, A.; Klungsoyr, J.; Jensen, A. INST. MARINE BIOCHEM., NTH, N-7034 TRONDHEIM-NTH. WATER RES., Vol. 21, No. 2, pp. 155-164, 1987.

Abstract: Aqueous stock solutions of Ekofisk crude oil were prepared in darkness and under illumination, and fractions of both types of stock solutions were further treated by controlled evaporation, illumination, extraction with hexane and dichloromethane and phytoplankton cultivation. Chemical analysis of all fractions were combined with toxicity testing based on the marine diatom Skeletonema costatum. Removal of the readily water-soluble aromatic hydrocarbons did not reduce the phytotoxicity of the solutions. Illumination led to a dramatic increase in both toxicity and the total amount of dissolved material. In no case did the hydrocarbon content exceed 5% of the total dissolved material, and the traditional analytical values referred to as "total hydrocarbon content" are therefore considered highly misleading. The toxicity of these aqueous oil solutions must apparently be ascribed to a multitude of slightly polar, oxidized compounds originating from the oil. DIALOG BIOSIS Previews File 5

61. **Outer Continental Shelf Environmental Assessment Program. Final Reports of Principal Investigators. Volume 30.** National Ocean Service, Anchorage, AK. Ocean Assessments Div., April 1985.

Abstract: A compilation of eight final reports dealing with population and trophics studies of seabirds in the Northern Bering and Chukchi Seas; population estimates and trends of Pribilof Island Seabirds; pelagic distribution of marine birds on the central Bering Sea Shelf; assessment of oil spill risk to birds; and simulation modeling of marine bird population energetics, food consumption and sensitivity to perturbation.
Sponsored by Minerals Management Service, Anchorage, AK. Alaska Outer Continental Shelf Office.
NTIS Order No.: PB86-134756/XAB; see also PB85-239598, PB86-134764. DIALOG NTIS FILE 6

62. **Outer Continental Shelf Environmental Assessment Program. Final Reports of Principal Investigators. Volume 36. Part 1 and Part 2.** National Ocean Service, Anchorage, AK. Ocean Assessments Div., December 1985.

Abstract: A compilation of 16 reports by authors associated with the Northwest and Alaska Fisheries Center, NMFS, NOAA, which evaluate the possible effects of oil development on the commercial fisheries of the eastern Bering Sea.
Sponsored by Minerals Management Service, Anchorage, AK. Alaska Outer Continental Shelf Office.
RN: OCS/MMS-85/0107.
NTIS Order No.: PB86-201605/XAB; see also PB86-171758. DIALOG NTIS FILE 6

63. **FATE AND PERSISTENCE OF CRUDE OIL STRANDED ON A SHELTERED BEACH.**
Owens, E. H.; Harper, J. R.; Robson, W.; Boehm, P. D. WOODWARD-CLYDE CONSULTANTS, 7330 WESTVIEW DRIVE, HOUSTON, TEX. 77055, U.S.A. ARCTIC, Vol. 40, Suppl. 1, pp. 109-123, 1987.

Abstract: Detailed observations, mapping and sampling were conducted following an experimental spill of 15 m3 of crude oil adjacent to the coast at Cape Hatt, Baffin Island, N.W.T. The beach could not retain all of the oil that reached the shoreline, and as a result, one-third of the spilled oil was recovered in cleanup activities on the water, approximately one-third was lost to the atmosphere and to the ocean and one-third remained stranded on the intertidal zone. The stranded oil was subject to natural cleaning processes during approximately 6 months of open-water periods from 1981 to 1983. Over this period the surface area of oil cover was reduced by approximately half, whereas estimates indicate that 80% of the oil initially stranded (5.3 m3) was removed. This natural removal of stranded oil occurred in a very sheltered environment. The reduction of the surface area and of the volume of oil resulted primarily from the physical processes associated with wave activity and ground-water leaching. By 1983 an asphalt pavement had developed in the upper intertidal zone on the beach-face slope. Total hydrocarbon concentrations of samples collected from the asphalt pavement indicated a significant increase in oil-in-sediment values in this zone to concentrations in the order of 2-5%. Oil removed from the beach was transported into the adjacent nearshore bottom sediments, where oil concentrations increased sixfold between 1981 and 1983. Physio-chemical weathering rates were relatively rapid immediately following the release of the oil, as the lower molecular weight (C1 to C10) hydrocarbons evaporated. Subsequent physio-chemical changes were heterogeneous: weathering and biodegradation progressing slowly where oil-in-sediment concentrations exceeded 1%. The primary conclusion from the investigations undertaken to date is that oil is removed in substantial quantities from the intertidal zone even in such a sheltered, low-energy arctic environment. Similar changes should also be expected from comparable environments in lower latitudes. DIALOG BIOSIS Previews File 5

64. **A FIELD EVALUATION OF SELECTED BEACH-CLEANING TECHNIQUES.**
Owens, E. H.; Robson, W.; Foget, C. R. WOODWARD-CLYDE CONSULTANTS, 7330 WESTVIEW DRIVE, HOUSTON, TEX. 77055, U.S.A. ARCTIC, Vol. 40, Suppl. 1, pp. 244-257, 1987.

Abstract: A series of experiments was conducted to evaluate selected countermeasures for the cleanup of oil on remote beaches. The experiments formed part of the Baffin Island [Canada] Oil Spill (BIOS) Project, which was conducted at Cape Hatt. N.W.T., between 1980 and 1983. An isolated lagoon was selected with a series of segregated bays that could be used for discrete experiments with control and countermeasure plots. Intertidal control plots

were established in 1980 at an exposed site and at a relatively sheltered location. The oil on the exposed intertidal control plot was removed rapidly by natural processes so that subsequent attention was focused on low wave energy sites. Countermeasure experiments were conducted in 1981 in the intertidal zone at a relatively sheltered site and in 1982 in the intertidal and backshore zones at a very sheltered beach. At each of these two locations, control and countermeasure plots were duplicated using an aged Lagomedio crude oil and a water in aged Lagomedio emulsion. Countermeasures were selected for testing on the basis of existing experimental or practical knowledge and the applicability to remote or arctic beach environments. The selected techniques were incendiary combustion, mechanical mixing, chemical dispersion, solidifying and low-pressure flushing. Samples of surface and subsurface sediments were collected throughout the experiments for total hydrocarbon and GC/MS analysis. Two chemical dispersants (BP 1100X and Corexit 7664) were effective on the relatively sheltered beach but neither was effective on the very sheltered beach due to the lack of wave energy to agitate or to redistribute the oil/dispersant mixture. The mechanical mixing of backshore sediments accelerated the removal of surface oil but increased subsurface hydrocarbon concentrations. Low-pressure flushing on the very sheltered fine-grained beach did not reduce surface hydrocarbon concentrations and resulted in higher oil in sediment concentrations when compared to an adjacent control plot. The solidying agent was an effective method for encapsulating oiled beach sediments. Over a five- to six-week period the control plot data indicates that rates of natural cleaning resulted in similar total hydrocarbon values when compared to the countermeasure plots. However, these results must be considered in the context of edge effects and dispersion that are a function of using small (10 m .times. 2 m) intertidal plots. Such plots represent only patchy contamination. As the experimental concept was aimed primarily at the cleanup of heavily contaminated beaches, the primary evaluation of the countermeasures relates to data obtained only from the first week of each experiment. Neither the incendiary device nor the low-pressure flushing techniques proved to be effective, whereas over this short period mixing and chemical dispersion demonstrated a potential to mitigate the effects of beach contamination or to accelerate the removal of stranded oil. DIALOG BIOSIS Previews File 5

65. **Multivariate Analysis of Petroleum Weathering in the Marine Environment-Sub Arctic.**
Payne, J. R.; et. al. National Ocean Service, Anchorage, AK. Ocean Assessments Div. ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF: FINAL REPORTS OF PRINCIPAL INVESTIGATORS. VOLUME 21, 681 pp., February 1984.

Sponsored by Minerals Management Service, Juneau, AK. Outer Continental Shelf Environmental Assessment Program.
NTIS Order No.: PB85-215796/XAB; see also PB82-185646. DIALOG NTIS FILE 6

66. **Integration of Suspended Particulate Matter and Oil Transportation Study. Final Report, September 1984-September 1987.**
Payne, J. R. ; Kirstein, B. E. ; Clayton, J. R. ; Clary, C.; Redding, R. Science Applications International Corp., San Diego, CA, September 1987.

Abstract: Dispersed oil droplet/suspended particulate material (SPM) interactions provide a potential mechanism for transport of spilled oil to benthic marine environments. Oil/SPM interaction rates were measured to develop a mathematical model for sedimentation of spilled crude oil and refined petroleum products. Data are presented for the interaction of fresh and weathered Prudhoe Bay crude oil with a representative suspended particulate material type.
Sponsored by Minerals Management Service, Anchorage, AK. Environmental Studies.
RN: SAIC-87/ETG-2; MMS-0083.
NTIS Order No.: PB88-116421/XAB; see also PB-87-121703. DIALOG NTIS FILE 6

67. **Pollution from Alaskan oil and gas operations. 1974-November, 1982 (Citations from Oceanic Abstracts). National Technical Information Serv., Springfield, VA (USA).**, 67 pp, 1982.

Abstract: This bibliography contains citations concerning environmental pollution mechanisms and effects associated with Alaskan oil and gas operations. Effects at specific locations and upon specific species are considered. Some attention is given to legal aspects of oil spills and other oil pollution sources. (This updated bibliography contains 66 citations, 12 of which are new entries to the previous edition).
NTIS Order No.: PB83-852822. DIALOG ASFA file 44

68. **Feasibility of dynamic models of the interaction of potential oil spills with bowhead and gray whales in the Bering, Chukchi, and Beaufort Seas.**
Reed, M.; Bowles, A. E.; Anderson, E. L.; Leatherwood, S.; Spaulding, M. L. Applied Science Associates, Inc., Wakefield, RI (USA), August 1984.

Abstract: Feasibility and design considerations for developing computer models of migratory bow-head and gray whales and linking such models to oil spill models for application in Alaskan Outer Continental Shelf areas were evaluated. A summary of all relevant bowhead and gray whale distributional and migration data were summarized and presented at monthly intervals. The data were, for the most part, deemed sufficient to prepare whale migration simulation models. A variety of whale migration conceptual models were devised and ranking was achieved by means of a scaling-weighted protocol. Existing oil spill trajectory and fate models, as well as conceptual models, were similarly ranked.
NTIS Order No.: PB-86-193950/XAB. DIALOG DOE Energy file 103

69. **Computer simulation of the probability that endangered whales will interact with oil spills, Final report.**
Reed, M.; Jayko, K.; Bowles, A.; Anderson, E.; Leatherwood, S. Dunham-Bush, Inc., Harrisonburg, VA (USA), October 1986.

Abstract: A numerical model system was developed to assess quantitatively the probability that endangered bowhead and gray whales will encounter spilled oil in Alaskan waters. Bowhead and gray whale migration diving-surfacing models, and an oil-spill-trajectory model comprise the system. The migration models were developed from conceptual considerations, then calibrated with and tested against observations. The distribution of animals is represented in space and time by discrete points, each of which may represent one or more whales. The movement of a whale point is governed by a random-walk algorithm which stochastically follows a migratory pathway.
NTIS Order No.: PB-87-121307/XAB.
RN: ASA-84-35. DIALOG DOE Energy file 103

70. **Computer simulation of the probability that endangered whales will interact with oil spills.**
Reed, M.; Jayko, K.; Bowles, A.; Anderson, E.; Leatherwood, S. Applied Science Associates, Inc., Narragansett, RI (USA), March 1987.

Abstract: A numerical model system was developed to assess quantitatively the probability that endangered bowhead and gray whales will encounter spilled oil in Alaskan waters. Bowhead and gray whale migration and diving-surfacing models, and an oil-spill trajectory model comprise the system. The migration models were developed from conceptual considerations, then calibrated with and tested against observations. The movement of a whale point is governed by a random walk algorithm which stochastically follows a migratory pathway. The oil-spill model, developed under a series of other contracts, accounts for transport and spreading behavior in open water and in the presence of sea ice. Historical wind records and heavy, normal, or light ice cover data sets are selected at random to provide stochastic oil-spill scenarios for whale-oil interaction simulations.
NTIS Order No.: PB-87-200085/XAB; supersedes PB-87-121307. DIALOG DOE Energy file 103

71. **Numerical Models of Bowhead and Gray Whale Migration in Alaskan Waters USA.**
Reed, M.; Jayko, K.; Bowles, A.; Leatherwood, S. Applied Sci. Assoc., 70 Dean Knauss Drive, Narragansett, R.I. 02882, USA. Ecol. Modell., Vol. 44, No. 1-2, pp. 1-42, 1988.

Abstract: Numerical models of migrating bowhead and gray whales were developed as part of a larger project to assess the probability that these endangered marine mammals will encounter spilled oil in Alaskan waters. The distribution of animals is represented in space and time by discrete points, each of which may represent one or more whales. The movement of a whale point is governed by a randon walk algorithm which follows stochastically a migratory pathway. The migration models rely on sightings of whales to define mean migration pathways. Distances traveled over 3-6 months, divided by the travel time, were used to estimate mean migratory speeds over appropriate sections of the migration route. Stochastic velocity components were added such that maximum instantaneous swimming speeds did not exceed those observed. Modeled whale densities were then compared with field estimated at various times and locations, as available, and mean migration speeds were adjusted locally to calibrate the model. The model proved to be an extremely useful tool for exploring the raw observational data, making clear a number of inconsistencies therein. DIALOG BIOSIS Previews File 5

72. **Toxicity of Ballast-water Treatment Effluent to Marine Organisms at Port Valdez, Alaska.**
Rice, S. D.; Korn, S.; Bordersen, C. C.; Lindsay, S. A.; Andrews, S. A. NOAA Natl. Marine Fisheries Service, AK. PRESENTED AT EPA/API/USCG 1981 OIL SPILL CONF, ATLANTA, MAR 2-5, 81, P55 (7)

Abstract: APPROXIMATELY 12 MILLION GPD OF OIL BALLAST WATER IS TAKEN ASHORE AND TREATED IN PORT VALDEZ, ALSK. MOST OIL IS REMOVED, BUT SOME LIGHT AROMATIC HYDROCARBONS REMAIN IN THE DISCHARGED EFFLUENT. THE TOXICITY OF THE EFFLUENT TO FISH AND SHRIMP LARVAE WAS STUDIED. THE MEDIAN LC 5 0 WAS 10-20% OF TREATED EFFLUENT IN 96 HR STATIC TESTS FOR LARVAE. (6 GRAPHS, 13 REFERENCES, 3 TABLES). DIALOG ENVIROLINE File 40

73. **Effects of Petroleum Hydrocarbons on Alaskan Aquatic Organisms: A Comprehensive Review of All Oil-Effects Research on Alaskan Fish and Invertebrates Conducted by the Auke Bay Laboratory, 1970-81. Technical memo.**
Rice, S. D. ; Moles, D. A. ; Karinen, J. F. ; Korn, S.; Carls, M. G. National Marine Fisheries Service, Auke Bay, AK. Auke Bay Lab., December 1984.

Abstract: This report reviews and summarizes all oil-effects research by the Auke Bay Laboratory from the beginning of these studies in 1970 through 1981. Both published and unpublished results from 62 studies are included. Research is reviewed according to subject (e.g., toxicity, sublethal effects, studies at Port Valdez).
RN: NOAA-TM-NMFS-F/NWC-67.
NTIS Order No.: PB85-185262/XAB. DIALOG NTIS FILE 6

74. **Shorebird dependence on Arctic littoral habitats.**
Risebrough, R. W.; Conners, P. G. Bodega Mar. Lab., Bodega Bay, CA 94923, USA. Office of Marine Pollution Assessment, Boulder, CO (USA). ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. ANNUAL REPORTS OF PRINCIPAL INVESTIGATORS FOR THE YEAR ENDING MARCH 1980. VOLUME 1: RECEPTORS - BIRDS, PLANKTON, LITTORAL, BENTHOS, pp. 94-109, 1980.

Abstract: Seasonal, and occasionally very heavy, use of littoral (shoreline) habitats by shorebirds and other birds in the Arctic are documented. For many bird species in some coastal areas it can now be predicted (for a hypothetical oil spill) the rate of encounter, on an area basis, of birds and oil. A limited series of choice experiments, using shallow pans containing brine shrimp in water, suggested that naive juvenile Red Phalaropes did not distinguish between oiled and clear surfaces for foraging before they had any experinece with the oil. However, upon contact they have a fairly consistent and very quick response to avoid the oil, and subsequently within the same trial period they can and do distinguish between oiled and clear surfaces, selecting clear surfaces. This

suggests that through behavioral responses, Red Phalaropes may reduce the impact of small coastal oil spills. However, survival rate may also depend on the type and thickness of the oil film, the degree of contact, the accompanying stress due to environmental factors, and the physiological state of the bird must also be considered. RN:NOAA-OMPA-AR-80-1. DIALOG ASFA file 44

75. **Distribution of hydrocarbon-utilizing microorganisms and hydrocarbon biodegradation potentials in Alaskan continental shelf areas.**
Roubal, G.; Atlas, R. M. Dep. Biol., Univ. Louisville, Louisville, KY 40208, USA. Appl. Environ. Microbiol., Vol. 35, No. 5, pp. 897-905, 1978.

Abstract: Hydrocarbon-utilizing microorganisms were enumerated from Alaskan continental shelf areas by using plate counts and a new most-probable-number procedure based on mineralization of SUP-14C-labeled hydrocarbons. Hydrocarbon utilizers were ubiquitously distributed, with no significant overall concentration differences between sampling regions or between surface water and sediment samples. There were, however, significant seasonal differences in numbers of hydrocarbon utilizers. Distribution of hydrocarbon utilizers within Cook Inlet was positively correlated with occurrence of hydrocarbons in the environment. Hydrocarbon biodegradation potentials were measured by using SUP-14C-radiolabeled hydrocarbon-spiked crude oil. There was no significant correlation between numbers of hydrocarbon utilizers and hydrocarbon biodegradation potentials. The biodegradation potentials showed large seasonal variations in the Beaufort Sea, probably due to seasonal depletion of available nutrients. Non-nutrient-limited biodegradation potentials followed the order hexadecane > naphthalene >> pristane > benzanthracene. In Cook Inlet, biodegradation potentials for hexadecane and naphthalene were dependent on availability of inorganic nutrients. Biodegradation potentials for pristane and benzanthracene were restricted, probably by resistance to attack by available enzymes in the indigenous population. DIALOG ASFA file 44

76. **Review of the Physical Oceanography of the Northeast Gulf of Alaska, With Emphasis on its Implications to Oil and Gas Development.**
Royer, T. C. Alaska Univ., Inst. Mar. Sci., Fairbanks, AK 99701, USA. ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. ANNUAL REPORTS OF THE PRINCIPAL INVESTIGATORS. VOLUME 6 - TRANSPORT, pp. 239-306, 1980.

Abstract: The knowledge of the physical oceanography of the northern Gulf.
RN:NOAA-OMPA-AR-80-6. DIALOG ASFA file 44

77. **Physiological responses of Arctic benthos and epibenthic invertebrates to salinity and crude oil stress under winter conditions.**
Schneider, D. E.; Hanes, J. Western Washington Univ., Bellingham, WA, USA. ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. ANNUAL REPORTS OF PRINCIPAL INVESTIGATORS FOR THE YEAR ENDING MARCH 1981. VOLUME 1: RECEPTORS - BIRDS, FISH, MARINE MAMMALS, PLANKTON, LITTORAL, pp. 470-531, 1981.

Abstract: Both acute and gradual salinity tolerance tests and associated activity ratings indicate that the Arctic shallow-water benthic invertebrates studied are not more tolerant to hypersaline stress than the epibenthic invertebrates. Acute salinity transfers resulted in high mortality at salinities of 55 ppt or less and severely depressed activity at around 45 ppt. Gradual salinity transfers in most cases resulted in less than a 5 ppt increase in the upper tolerance limit and almost no improvement in the upper limit for activity. The physiological responses to hypersaline stress in the benthic invertebrates studied suggest that most of these species are unable to live in areas of lagoons that exceed salinities of about 50 to 55 ppt. These species may therefore be absent from certain regions in the deepest parts of the lagoons. Two species, the epibenthic amphipod Boeckosimus affinis and the isopod Saduria entomon, appear capable of surviving at least limited exposure to the hypersaline extremes seen in Beaufort Sea lagoon systems during late winter and early spring. Limited experiments on crude oil tolerance suggest that benthic species may not be as sensitive to low level of oil contamination as epibenthic species.
RN: NOAA-OMPA-AR-81-1. DIALOG ASFA file 44

78. **DESIGN AND CONCLUSIONS OF THE BAFFIN ISLAND OIL SPILL PROJECT CANADA.**
Sergy, G. A.; Blackall, P. J. ENVIRON. PROT., CONSERV. PROT., ENVIRON. CANADA, TWIN ATRIA NO. 2, 2ND FLOOR, 4999 - 98 AVE., EDMONTON, ALBERTA, CAN. T6B 2X3. ARCTIC, Vol. 40, Suppl. 1, pp. 1-9, 1987.

Abstract: The Baffin Island Oil Spill (BIOS) Project sponsored multidisciplinary field studies between May 1980 and August 1983 in Canada's eastern Arctic at Cape Hatt, on the northern end of Baffin Island. Forty-five cubic metres (45 000 l) of a sweet medium gravity crude oil were released in a typical coastal arctic environment for purposes of scientific investigation. The experimental spills were monitored to quantitatively assess and compare the short- and long-term fate and effects of chemically dispersed oil and a beached oil slick, as well as the effectiveness of shoreline cleanup techniques. Hydrocarbon analyses were carried out on water samples, intertidal sediments, subtidal sediments and macrofaunal tissue. Biological measurements were made on populations of macrophytic algae, benthic infauna and epifauna and microorganisms. Oceanographic, geomorphologic and meteorologic support studies were also performed. The main conclusions of the BIOS Project relate to oil spill countermeasures for arctic nearshore and shoreline areas typified by the experimental site. First, the results offer no compelling ecological reasons to prohibit the use of chemical dispersants on oil slicks in such nearshore areas. Second, the results provide no strong ecological reasons for the cleanup of oil stranded on such shorelines. Thus consideration would be given to the use of chemical dispersants in the nearshore where prevention of shoreline contamination is warranted to protect wildlife or their critical habitat or traditional human land-use sites. DIALOG BIOSIS Previews File 5

79. **Experiments on the response of sea otters Enhydra lutris to oil contamination.**
Siniff, D. B.; Williams, T. D.; Johnson, A. M.; Garshelis, D. L. Dep. Ecol. & Behav. Biol., Univ. Minnesota, Minneapolis, MN 55455, USA. Biol. Conserv., Vol. 23, No. 4, pp. 261-272, 1982.

Abstract: Two oiling experiments were conducted from 1977-1979 on sea otters Enhydra lutris in Prince William Sound, Alaska. In the first experiment, four captured otters were fitted with radio-transmitters and released following contamination of their pelage with 25 cc of Prudhoe Bay crude oil a fifth individual was oiled and cleaned with detergent prior to being released. For all experimental animals, activity increased dramatically during the first week following treatment; this effect was accentuated in the otter cleaned with detergent. Most of the increase in activity corresponded to increased grooming, whereas the feeding pattern (as measured by dive time analysis) did not change. It appeared that all experimental otters survived the first experiment, probably because only a small portion of the pelage was treated, and because food resources in the study area were abundant. In the second experiment the authors observed behavioural reactions of two otters in an above-ground swimming pool which was partly covered with crude oil. DIALOG ASFA file 44

80. **THE RINGED SEAL PHOCA-HISPIDA OF THE CANADIAN WESTERN ARCTIC.**
Smith, T. G. DEP. FISHERIES AND OCEANS, ARCTIC BIOL. STN., 555 ST.-PIERRE BLVD., SAINTE-ANNE-DE-BELLEVUE, QUEBEC H9X 3R4. CAN. BULL. FISH. AQUAT. SCI., (216), I-X, 1-81, 1987.

Abstract: I studied ringed seals, Phoca hispida, during the years 1971 to 1983 from Holman in Amundsen Gulf, N.W.T., and several other localities in the southeastern Beaufort Sea. The highest densities of ringed seals (2.84/km2) were found in Prince Albert Sound, Amundsen Gulf. Each year this becomes an area of good stable landfast ice which is consistently used as a breeding habitat. Age structure of the catches indicates segregation of older animals occupying fast-ice areas in the winter and spring, with all age classes being present in the summer open-water period. In the autumn, young-of-the-year and adolescents move west along the coast of Amundsen Gulf and southeastern Beaufort Sea. Seals tagged in this study were recovered as far west as Point Barrow, Alaska [USA] and Injun, Siberia [USSR]. Prime breeding ice in Amundsen Gulf is characterized by being stable with ice hummocks or pressure ridges which provides areas for accumulation of snow in which subnivean lairs are constructed. Lairs serve the dual function of providing protection from predators and as a thermal shelter. Both polar bears, Ursus maritimus, and arctic foxes, Alopex lagopus, kill seals in their lairs. Arctic foxes are the most important predators of ringed seal pups in the western Canadian arctic. Strong territoriality exists in the breeding habitat. A limited form of polygyny exists in the ringed seal breeding population; one male maintains a territory which includes several females with their sub-territories of birth-lair complexes. A significant decrease in the number of birth lairs found during dog searches was documented in 1974 and 1975. In 1975 it was also found that the number of lairs occupied by rutting males was severely reduced. Predation by arctic foxes was at a peak in the spring of 1973, one year prior to the highest fox trapping harvest yet recorded for the area. High fox predation continued in the springs of 1974 and 1975 even though the number of ringed seal pups born had been severely reduced. Ringed seal pups are born in mid April. Ovulation occurs on average, 21 May, with implantation of the blastocyst on 18 August. There is an active gestation of 241 days with a delay of implantation of 89 days. Females are sexually mature at 5.61 years with the mean age of first reproduction being attained at 7.67 years. The pup sex ratio at birth is 1:1. Mean reproductive rates in normal years are calculated as 0.56. In 1974 and 1975 ovulation rates were reduced to the low values of 0.41 and 0.38, respectively, compared to the mean rate of 0.89 in other years. The index of body condition of adult seals was also significantly reduced in both 1974 and 1975. The length at birth of seals in this study area is calculated to be 632 mm (STL) with a foetal growth rate of 2.2 mm/day; post-natal growth to weaning is 6.1 mm/day; and post-weaning growth is reduced to a low of 0.099 mm/day for the remainder of the year. There is an indication of severe stunting in 4% and moderate stunting in 11% of the seals measured in this study. It appears to be related to date of birth and poor feeding conditions during the first year of life. Ringed seals feed on a variety of crustaceans during the open water season including Parathemisto libellula, Thysanoessa raschii and Mysis oculata. Arctic cod, Boreogadus saida, is the most important food of all ages of ringed seals during the ice covered period. There is evidence of feeding competition between adolescents and adults as shown by different prey items and diurnal feeding times. All age classes lose body condition from spring through to early September. Autumn feeding on arctic cod by groups of adult ringed seals occurs regularly, and this is an important time for the seals to regain body condition. It is also probably the proximate cause, through territorial exclusion, of the migration of young and adolescents westward along the mainland coast towards the Beaufort and Bering Seas. Survivorship values estimated from catch curves do not present either a clear or accurate picture of the annual changes in a ringed seal population. They reflect the drastic reduction in recruitment documented from reproductive data and breeding habitat evaluation in 1974 and 1975, but would not be sensitive enough to point to the nature of the change on their own. The inadequacy of a klx type life table is underlined by the changes in recruitment documented in this study, which violates the basic assumptions of population stability needed for such an analysis. The marked decrease in recruitment of 1974 and 1975 seems to be about equally influenced by reduced ovulations and increased pup mortality from fox predation. Many changes have occurred in the Canadian arctic in the past 20 years. The subsistence culture of the Inuit is being replaced by a cash-revenue economy. Modern Inuit depend on the sale of furs and seal pelts to finance their hunts which provide the main source of food for their growing population. Recent European anti-sealing campaigns have severely affected the ability of the Inuit to generate enough cash from hunting to pay their operating costs. Recent concerns of the Inuit and environmentalists involve the impacts of industrial development especially from the petroleum industry on seals. Oil spills, which have not yet occurred on a large scale are not thought to pose as serious a threat to seals as was once envisaged. Adult ringed seals are able to withstand and recover from immersion in oil, but the effects on newborn seals would be more severe. Other oil-related impacts such as disturbance from ice-breaking tankers and underwater noise are more difficult to assess empirically. The effect of contaminants such as heavy metals and chlorinated hydrocarbons is not thought to be a major problem in the Canadian north. Integrated ecosystem research is needed to identify the mechanisms involved in regulation of marine mammal populations. This study has documented a significant reduction in ovulation in 1974 and 1975 which resulted in reduced recruitment. This was correlated to a significant reduction in body condition in the same years, but we have no quantitative information about fish or their availability, or on other levels of production in the ecosystem. New techniques including radio telemetry and satellite remote sensing are available and should be used to study ringed seals. The projected doubling of the

Inuit population by the year 2000 will place more pressure on ringed seal populations, which will be increasingly used as human food. DIALOG BIOSIS Previews File 5

81. **THE BIOLOGICAL SETTING OF THE BIOS SITE AT CAPE HATT NORTHWEST TERRITORIES CANADA INCLUDING THE SAMPLING DESIGN METHODOLOGY AND BASELINE RESULTS FOR MACROBENTHOS.**
Snow, N. B.; Cross, W. E.; Green, R. H.; Bunch, J. N. BOX 2120, INUVIK, N.W.T., CAN. X0E 0T0. ARCTIC, Vol. 40, Suppl. 1, pp. 80-99, 1987.

Abstract: The Baffin Island Oil Spill (BIOS) Project was carried out in nearshore shallow waters at Cape Hatt, northern Baffin Island. Observations and limited data on phytoplankton, zooplankton, fishes, birds and mammals at Cape Hatt and more detailed information on microheterotrophs indicate that the BIOS site is typical of the majority of eastern and central High Arctic coastal areas. Detailed baseline information on nearshore macrobenthos (infauna, epibenthos and macroalgae) is, in general, similar to that previously reported for other eastern and central arctic locations; comparisons were hindered by a scarcity of detailed studies elsewhere, differences in sampling methods and complexity in infaunal community structure. Infaunal density (means from 1119 to 3981 individuals .cntdot. m-2 in different study bays and sampling periods) was dominated by polychaetes, especially Pholoe minuta, whereas infaunal biomass (59-2267 g.cntdot.m-2) was dominated by bivalves, primarily Mya truncata. Epibenthic crustaceans (207-2527 individuals.cntdot.m-2) were dominated by ostracods, amphipods (notably Guernea sp.) and cumaceans (Lamprops fuscata). The sea urchin Strongylocentrotus droebachiensis (up to 10 individuals.cntdot.m-2) and the seastar Leptasterias polaris (up to 2 individuals.cntdot.m-2) were the large and conspicuous echinoderms on study transects. Macroalgal biomass was from 178 to 1112 g.cntdot. m-2 (not including a Laminaria zone); communities at 3 m depth were dominated by loose-lying understory algae, particularly Stictyosiphon tortilis, Pilayella littoralis and Dictyosiphon foeniculaceus. The deeper transects (7 m) supported a considerably higher infaunal biomass and density of epibenthos than did 3 m transects in both sampling periods, whereas depth differences in macroalgal biomass varied from September 1980 to August 1981. An evaluation of the sampling design and procedures used in this study (including efficiency of the diver-operated airlift sampler; the area, location and number of replicate samples collected; and bias, efficiency and consistency in laboratory analysis) indicated that representative samples of the nearshore macrobenthic communities were obtained. The study design and analysis of variance procedures used to analyze the data provided a rigorous framework within which oil effects were evaluated. DIALOG BIOSIS Previews File 5

82. **SEASONAL VARIATIONS IN WEATHERING AND TOXICITY OF CRUDE OIL ON SEAWATER UNDER ARCTIC CONDITIONS.**
Sydnes, L. K.; Hemmingsen, T. H.; Skare, S.; Hansen, S. H.; Falk-Petersen, I-B; Lon Ning, S.; Ostgaard, K. DEP. CHEM., UNIV. TROMSO, N-9001 TROMSO, NORWAY. ENVIRON. SCI. TECHNOL., Vol. 19, No. 11, pp. 1076-1081, 1985.

Abstract: The present study shows that oil in Arctic marine environment is modified by several processes. From October to February the oil composition is mainly affected by evaporation. During the rest of the year the composition is considerably influenced by photooxidation and subsequent dissolution of polar oxidation products in the water phase. These products are toxic and may represent a hazard to marine organisms in the Arctic spring and summer. DIALOG BIOSIS Previews File 5

83. **North Aleutian Shelf Environment and Possible Consequences of Offshore Oil and Gas Development. Proceedings of a Synthesis Meeting held at Anchorage, Alaska on March 9-11, 1982. North Aleutian Shelf Environment and Possible Consequences of Offshore Oil and Gas Development: Synthesis Meeting Anchorage, AK (USA) 9-11 Mar 1982.**
Thorsteinson, L. K. National Ocean Serv., Rockville, MD (USA). Off. of Oceanography and Mar. Serv., 178 pp, 1984.

Abstract: Results and conclusions of a NOAA/OCSEAP synthesis meeting are summarized herein. Prediction of oil spill behavior and potential effects of several hypothetical oil spills on biota are based on OCS exploration and development scenarios established prior to the meeting by the Minerals Management Service. These scenarios and corresponding physical and biological assumptions formed at the meeting for analyses of potential impacts are described in the introduction and in following chapters documenting the proceedings of individual workshops, respectively. Since the North Aleutian Shelf sale was deferred shortly after this synthesis meeting was held, many assumptions such as recoverable resource and spill estimates and hypothetical oil spill point sources, may differ from those described in this report.
NTIS Order No.: PB84-209428. 8502. DIALOG ASFA file 44

84. **ON THE ENVIRONMENTAL FATE OF A DISPERSED EKOFISK CRUDE OIL IN SEA-IMMERSED PLASTIC COLUMNS.**
Tjessem, K.; Pedersen, D.; Aaberg. A. STAT OIL, P.O. BOX 300, SVK, N-H001, STAVANGER, NORWAY. Water Res., Vol. 18, No. 9, pp. 1129-1136, 1984.

Abstract: The environmental fate of dispersed nonviscous crude oils was investigated using a tritiated and a nonlabeled Ekofisk crude oil. The respective oils (1/2 l) were poured onto the water surface of 2 large plastic enclosures of sea water at 60.degree. latitude north of Bergen, Norway during June, 1980. The resulting slicks were treated with a nonlabeled detergent, Corexit 9527, 24 h after the initial addition of the oil. Two replicate ecosystems without the added detergent served as control. A high concentration of polar petroleum-derived components exceeding the concentration of petroleum hydrocarbons several-fold was found in the oil/dispersant enclosures, which together with transformation products of the dispersant Corexit 9527 proved fairly toxic to several marine biota. Photooxidation of the oil/dispersant mixture had been invoked as a primary mechanism to explain the formation of polar substances being leached into the water column. DIALOG BIOSIS Previews File 5

85. **Proceedings of a synthesis meeting: The Barrow Arch Environment and Possible Consequences of Planned Offshore Oil and Gas Development, held at Girdwood, Alaska, 30 October-1 November 1983. The Barrow Arch Environment and Possible Consequences of Planned Offshore Oil and Gas Development, Girdwood, AK (USA) 30 Oct-1 Nov 1983.**
Truett, J. C. LGL Ecological Research Associates, Inc., Bryan, TX (USA), 242 pp, 1984.

Abstract: This synthesis report presents and evaluates available environmental data-transport and fate of pollutants, environmental hazards, biota and their food resources and habitats, and socioeconomic issues-related to potential petroleum development in the Barrow Arch OCS Planning Area (Chukchi Sea). It is based to a great extent on information brought together at the first Barrow Arch Synthesis Meeting, held in Girdwood, Alaska, 31 October-2 November 1983. Information presented at the synthesis meeting has been complemented by extensive outside review to provide as complete a synthesis as possible. Chapters are included on transport and fate of spilled oil, environmental hazards, marine mammals, marine and coastal birds, fish resources, lower trophic levels, coastal ecosystems and sensitivities, subsistence economics and marine resource use patterns, and socioeconomic issues. NTIS Order No.: PB85-202240/GAR. DIALOG ASFA file 44

86. **UPDATED STATUS OF THE HUMPBACK WHALE MEGAPTERA-NOVAEANGLIAE IN CANADA.**
Whitehead, H. DEP. BIOL., DAHOUSIE UNIV., HALIFAX, NOVA SCOTIA B3H 4J1. Can. Field-Nat., Vol. 101, No. 2, pp. 284-294, 1987.

Abstract: Humpback Whales, Megaptera novaeangliae, are principally coastal animals found off both the east and west coasts of Canada. The eastern north Pacific population breeds in winter off Hawaii [USA], Baja California and the Mexican mainland, and feeds in summer from Alaska to central California. The western north Atlantic Humpback Whales' principal winter breeding grounds are on Silver and Navidad banks in the West Indies, and they feed in summer from Cape Cod to West Greenland. Humpback Whales are rarely sighted off British Columbia. However, along the east coast of Canada substantial concentrations are found on the Southeast Shoal of the Grand Banks, off eastern Newfoundland, and southern Labrador, with smaller numbers off southern Newfoundland, in the Gulf of St. Lawrence, and off southwestern Nova Scotia. Population estimates in both oceans show considerable scatter, but suggest approximately 2000 animals in the eastern north Pacific, and 4000 in the western north Atlantic, both less than the estimated pre-whaling populations. It is unlikely that either population is decreasing. Humpback Whales have shown indications of adverse effects from vessel traffic and overchanges in prey abundance. A fisheries conflict, with Humpback Whales becoming entangled in fishermen's nets, resulted from this redistribution between 1977 and 1980. Humpback Whales are vulnerable to disturbance on their restricted breeding grounds, and to development in fisheries, oil exploration and exploitation, and pollution in their feeding areas. The Humpback Whale is particularly significant to the whale-watching industry, and has become a focus of scientific investigation. DIALOG BIOSIS Previews File 5